ELECTRONICS Australia

INCORPORATING "RADIO, TELEVISION AND HOBBIES"

Volume 27, No. 12

ABC certified circulation in excess of 45,000

Editor:
NEVILLE WILLIAMS, M.I.R.E.E. (Aust.) (VK2XV)

Assistant Editor:
PHILIP WATSON, A.M.I.R.E.E. (Aust.) (VK2ZPW)

Technical Editor:
JAMIESON ROWE, B.Sc. (Tech.), Grad. I.R.E.E. (Aust.).

Technical Staff:
IAN POGSON (VK2AZN),
KEITH WOODWARD (VK2ZAU),
HARRY TYRER,
MICHAEL MEECHAN (VK2UF),
ROBERT FLYNN.

Editorial Offices:
12th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2531, 2525-6-7.

Postal Address:
Box 2728, G.P.O., Sydney, Australia.

Advertising:
SELWYN SAYERS, Mgr.
BILL SUMMONS, Rep. Sydney.
CLARRIE LEVY, Rep. Melbourne.
Offices: 8th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2931, 2508, 2943.

Circulation:
W. CUMMINGS, Mgr.
Offices: 9th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2505, 2509.

Subscription Rates:
See back page.

Representation:
Melbourne—John Fairfax & Sons Ltd., 392 Little Collins Street. Phone 67-8131
Brisbane—Sungravure Pty. Ltd., 78 Elizabeth Street. Phone 2-6688.
Adelaide—John Fairfax & Sons Ltd., 104 Currie Street. Phone 51-3502.
Perth—Sungravure Pty. Ltd., 847 Hay Street. Phone 23-4513.
Newcastle, N.S.W.—Associated Newspapers Ltd., 22 Bolton Street. Phone 2-3696.
London—John Fairfax & Sons (Aust) Ltd., Reuter Building, 85 Fleet Street.
New York—"The Sydney Morning Herald" Ltd., "Times Annex," 229 West 43rd Street.

Distribution:
Distributed in N.S.W. by Sungravure Pty. Ltd., Jones St., Broadway, Sydney, N.S.W.; in Victoria by Sungravure Pty. Ltd. 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty. Ltd., 104 Currie Street, Adelaide; in Western Australia by Western Press; in Queensland by Gordon and Gotch (A'sia) Ltd.; in New Zealand by Truth (N.Z.) Ltd.; in Tasmania by Davies Bros Ltd., "Mercury," Hobart.

COVER PICTURE

A means of classifying thousands of colours is provided by a set of charts prepared by National Bureau of Standards, U.S.A. Each chart contains 1" sq. chips representing the colour gamut of a particular hue, e.g., from greenish black to greenish white and from deep green to brilliant green The charts are to be used with N.B.S. Circular 553. Price of the charts from National Bureau of Standards, Washington, is $US3.00.

Advertisements

From references in our mail, it is clear that some readers do not properly understand the basis on which advertisements are published in "ELECTRONICS Australia" or in other comparable overseas journals. "Why print so many advertisements," readers have asked. "Or why spread over a page what could be said in a few inches?"

In fact, the sale of advertising space represents a vital source of revenue for most newspapers and magazines. With good advertising support, it is possible to produce an acceptable journal at a reasonable price; without advertising revenue, readers would have to pay a lot more for a lot less—even assuming that the journal could pay its way at all!

Having purchased space, an advertiser has a large degree of freedom as to how it shall be used. He may occupy the space with large type or large illustrations; he may leave lots of white space, or cram it tight with small print—depending on what he is trying to achieve. And while a poorly conceived advertisement can be a waste of money, well-conceived advertisements add considerably to the reference value of a journal. It has rightly been remarked that "ELECTRONICS Australia" is the shop window of the industry in this part of the world.

That's the way we would like to think of it.

Readers occasionally ask whether the magazine, through its Editor, assumes responsibility for the contents of advertisements—the quality of the items advertised, the accuracy of specifications, the fairness of the prices and whether they conform to trade mark-ups, etc. The answer is "No" and, in this respect, "ELECTRONICS Australia" is no different from other comparable journals.

A typical issue, such as this one, carries well over 150 different advertisements, ranging in size from double-page spreads to small insertions on the "Classified" page. In these advertisements are mentioned tens of thousands of individual items, of which it would be quite impractical for an editorial staff to keep track. We follow the custom of other journals and publish advertisements "in good faith."

This does not mean, however, that we don't care. We certainly do care when we come across any attempt to use our columns for malpractice and, on more than one occasion, we have exercised our rights to prevent it.

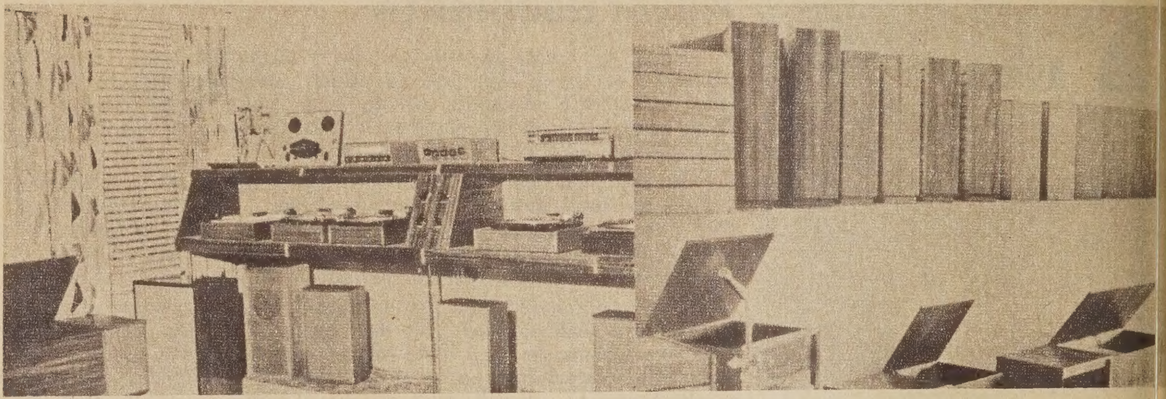
N. Williams

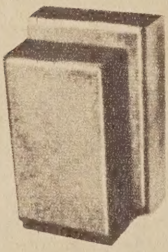
March, 1966

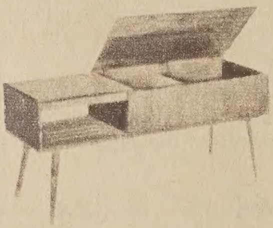
The Art of Xerograpby 4
Largest Insurance Office .. 11
Road Safety Electronics Part 2 12
E.D.P. and Market Research 17
Review—Train Weighing .. 21
Review—Pulse Sound in TV 23
Scientific and Industrial News 25
Playmaster 113 Power Amplifier 32
"Vari-tach" Motor Speed Control 43
Forum 49
Probes for 1966 V.T.V.M. .. 55
The Serviceman 63
The ABC-Four 69
Breadboard Hookups — 1966 Style 72
Answer Man 83
Capacitance Measurements .. 86
Audio Topics 91
Classical Reviews 97
Documentary Records 101
Variety Fare 105
Trade Reviews and Releases 117
Amateur Band News, Notes 120
Listening Around the World 133
Books and Publications 139
Answers to Correspondents .. 141
Index to Volume 27 142
Classified Advertisements 143
Index to Advertisers 144
Classified Ad. Form 144
Subscription Form 144

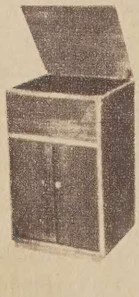
BROADWAY ELECTRONIC

NEW *Audio Sales & Service Cent*









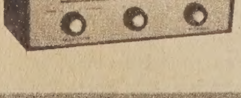
HIGH QUALITY AUDIO EQUIPMENT

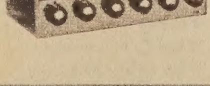
Every requirement of the hi-fi enthusiast is catered for at our new audio showrooms. No. 32 is located only 100 yards off Broadway in Glebe Pt. Road. Parking is O.K. right outside the door and we are open on Saturday mornings. A complete range of Playmaster amplifiers and tuners is available, all precisely to this magazine's specifications. These may be purchased as built and tested units or in kit form to build yourself. (Send coupon for free catalogue). Other well known names in imported amplifiers, tape recorders, etc. are available. We carry big stocks of players, speakers and cartridges, Wharfedale, Goodmans, Dual, Labcraft, Decca, etc. etc.

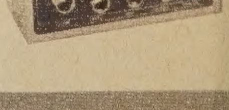
You are cordially invited to call, discuss your requirements with us, and to see and hear first class audio gear in operation.

INSTROL HI-FI FURNITUR
BUILT and POLISHED or
KITS TO BUILD YOURSEL

This is really high quality audio furn
ture, tailored to suit the equipment
your choice, and most reasonab
priced. All designs are available as k
to build yourself at little more than h
cost. There are over 20 standard equi
ment cabinet and enclosure desig.
We will gladly quote and supply cab
nets or kits to suit your own spec
ideas. Only highest grade laminat
veneered timbers are used. Everythi
is pre-cut in the kits. No skill is requir
to assemble and polish from the illu
trated instructions included with ea
kit. No special tools required, only
hammer and screwdriver. The result
a completely professional looking pie
of furniture. Send coupon for the fr
Instrol Cabinet catalogue.



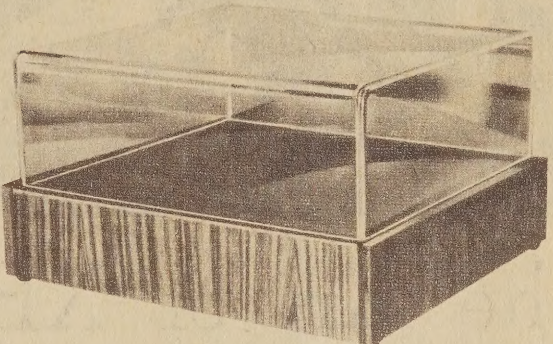




. . . 4 new releases . . .

INSTROL PERSPEX PLAYER COVER

An attractive, one piece, lift off clear plastic cover, complete with stand. The inside measurements of the cover are 15" x 14" x 5" — suitable for most makes of players such as Dual, Labcraft, Garrard, Elac, B.S.R., etc. etc. We will cut the stand to suit your player if you enclose template with your order.



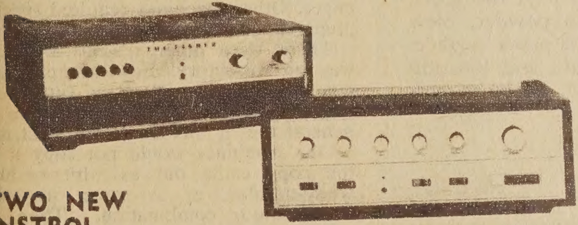
Price:

Cover with polished Qld. Maple or oiled Walnut stand	$18.00
Cover with oiled Teak stand	$19.25
Perspex Cover only	$9.60
Cutting Stand extra	75c

(add postage $2)

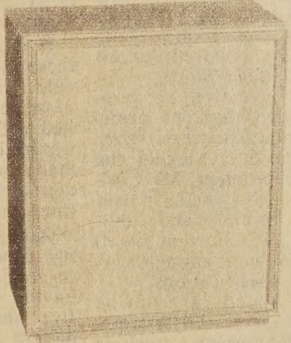
FISHER AMPLIFIERS

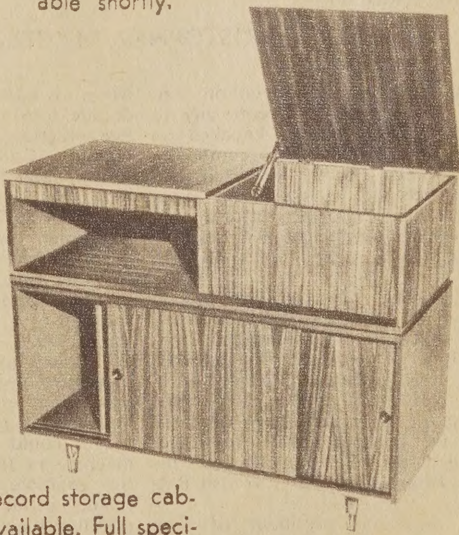
Arriving late February or early March, limited stocks of what is probably the world's finest and best known amplifier. Two models available X100A which is 17 watts RMS per channel and the 101C of 27 watts RMS per channel. The X100A will sell for $240 and the 101C $294 (both less cabinets). Printed literature will be available shortly.



TWO NEW INSTROL CABINETS

A smart 2 cu.ft. vented enclosure which closely follows the Wharfedale specifications. Made from ¾" laminated timbers, with Innerbond wadding it is ideally suited for Goodman's, Wharfedale and most makes of 8" and 10" speakers. Also a high quality combination equipment and record storage cabinet. A longer version to incorporate tape recorder is also available. Full specifications in the Instrol Cabinet catalogue.





ROADWAY ELECTRONICS PTY. LTD.

32 GLEBE ROAD, GLEBE.
SYDNEY. Phone 68-1171.
(only 100 yards off Broadway)

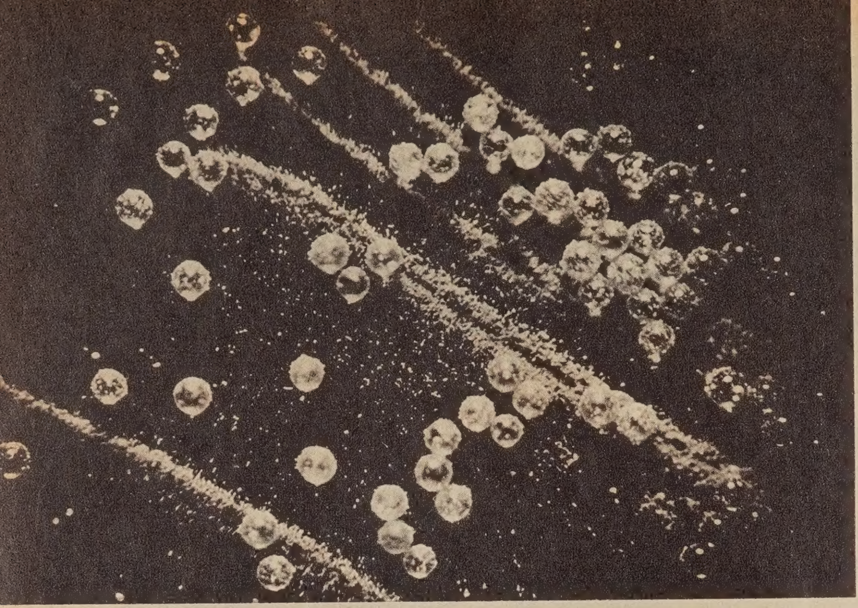
Please send me (mark X against catalogue required).

☐ HI-FI catalogue ☐ INSTROL CABINET Cat.

☐ FISHER leaflet

Name ....

Address ....



Photomicrograph of xerographic images being formed. The large positively charged carrier beads transport negatively charged toner particles to the positively charged selenium-coated plate. The carrier beads are 100-200 times larger than the toner particles. The dry developer powder is a special formulation of small glass or sand carrier beads plus particles of heat-fusible carbon.

The Art of XEROGRAPHY

ON October 22, 1938, a young physicist and patent attorney, Chester F. Carlson, wrote "10,-22,-38 Astoria" on a piece of glass. Then working in a darkened room with another physicist as a laboratory assistant, they rubbed a sulphur-coated metal plate with a handkerchief and quickly exposed the plate to light transmitted through the glass. Next, they sprinkled the plate with dyed lycopodium powder, blew lightly over it, and pressed a sheet of waxed paper to the paper surface. When the paper was pulled free of the plate, the date and location were reproduced, and xerography (Carlson called it "electrophotography") was born.

By CHRISTOPHER M. CELENT*

Carlson patented his invention and then set out to find some company to refine and develop it. He knocked on the doors of some 20 to 30 companies without success. But he persisted, and in 1944 succeeded in interesting scientists at Battelle Memorial Institute. Battelle, a research organisation located in Columbus, Ohio, agreed to study the process.

In July, 1944, "Radio News" magazine (now "Electronics World") heard about the invention and published a technical analysis. A year later, Dr John H. Dessauer, the research director of a small company in Rochester, N.Y., read an abstract of the article, then obtained and read the original article. Intrigued, he arranged for the president of his company, Joseph C. Wilson, to visit Battelle.

Wilson was the president of The Haloid Company, then a small, moderately successful sensitiser of photographic and photocopy papers and manufacturer of photocopying machines. Wilson saw promise in the new idea and sponsored further research both at Battelle and within his own company. In 1947, Haloid obtained partial rights to the process and launched an intensive development program.

Thus the seeds of invention were sown, germinated, and nurtured. They were to bloom in little more than a decade into a revolution in business office practices and to catapult the little Haloid Company—renamed Haloid-Xerox, later Xerox Corporation — into the ranks of the five hundred largest corporations in the United States.

Chester Carlson's invention of xerography was no sudden flash of genius nor was it an accidental discovery. When he "discovered" it he was seeking the solution to a specific problem. Mr Carlson, in 1935, was working in the patent department of P. R. Mallory and Company (and going to law school at night) and never seemed to have enough carbon copies of patent specifications.

He could have found a copying machine in 1935, of course. There were, for example, the Rectigraph machine (made incidentally, by Haloid), blueprinting machines, machines using the photographic processes, and others. But there were serious deficiencies in the copies made by these machines and in the way these copies were produced.

The time it took to get a copy is a good example of the problems he faced. It took about 30 minutes for each copy made and the machines of that day were so complicated that it took special training to operate them as well as special locations for the machines.

The process most likely involved handling "messy" chemicals which gav off offensive odours. Other objection were that the copy was often faint, hard to-read, and not very permanent, o printed on hard-to-handle or flims paper. Other machines required speciall prepared masters.

There were other reasons why cop was unsatisfactory. For example, som machines would not copy certain co ours. When the ball-point pen came int general use, it was discovered that man of the machines would not copy it. O the copy came out as white-on-blacl white-on-blue, or in some other-thar usual colour combination. Then, to only single sheets could be copied – often at some risk that the origin would be destroyed.

It is interesting to note that some o these faults were not really objectio able back in 1935. As a matter of fac most people then would have been sati fied with almost any kind of copies th would last, were legible, and could b made quickly and cheaply. But the r quirements of the customer became r fined and he demanded better copies.

Xerography is an electrostatic cop ing process. It makes use of the bas principle of static electricity; objec having opposite electrical charges (pos tive and negative) attract and objec having the same charge (both positi or negative) repel.

There are two commonly used xer graphic copying techniques employi electrostatic principles. One techniqu uses a re-usable plate or drum coate with a photoconductor, usually seleniu The second technique uses paper spec ally coated with a photoconductor suc as a zinc oxide mixture. Such precoate papers are not re-usable.

Each of these xerographic techniqu has been used successfully in documen copying machines. Systems based o re-usable drums employ the "transf electrostatic process." The precoate paper systems use the "direct electr static process." References to xer graphy in the remainder of this artic pertain mainly to the "transfer electrostatic process."

---

*Research & Engineering, Xerox Corporation. Reproduced by arrangement from "Electronics World", July 1965.

The heart of the selenium-based systems is an aluminium plate, or substrate, coated with a thin film of amorphous selenium. In automatic systems, the plate is in the shape of a cylinder, or drum. The extremely thin layer of selenium is a photoconductor, that is, its electrical conductivity changes when it is subjected to light. The glass-like selenium layer also accepts an electrostatic charge. If kept in darkness, the layer retains that charge long enough to be put to use. However, if exposed to light, the charge dissipates (leaks through the selenium layer to the aluminium substrate) quite rapidly. If only a portion of the selenium is exposed to light, the charge dissipates only in that area and the unexposed part retains the charge, in other words, the amount of lateral dispersion of the charge is entirely insignificant.

There are five basic steps in the xerographic process. The plates are charged, exposed, and developed. At the end of the developing step there is a powder image on the plate. This image is then transferred to paper and fused. As a final measure the plate is cleaned. Let us examine each step in turn (figure 1).

The selenium is charged by passing a wire held at high potential over its surface. If the surface is a drum, as in automatic machines, the cylinder is rotated under the wire. The electrical potential on the wire is held high enough so that a corona (glow discharge) is produced and maintained. The plate is literally sprayed with positive or negative ions—the choice of charge depends on the type of document (a negative or a positive) to be copied. In advanced xerographic machines, a system of wires and grids is used to ensure that the surface of the selenium receives a uniform charge. Charging must be carried out in darkness.

In the second step, exposing, the image to be copied is projected optically to the sensitized plate. When light from the image strikes the sensitized selenium surface, it affects the uniformly distributed charge. Suppose, for example, the original is an ordinary business letter. Those areas of the charged surface which are struck by light rays reflected from the white areas of the document lose most or all of their electrical charge. Light is not reflected from the black areas (the type on the letter) so those areas of the selenium return their charge. The result is a pattern of electrical charges on the selenium plate which corresponds exactly to the image being exposed. This pattern is called the "latent electrostatic image." A strong electrostatic field is established between the charged and uncharged areas of the selenium plate.

The third step in the process is to develop the electrostatic image. This is done by pouring (cascading) a developer over the plate surface. The developer is a granular material made up of two components: small glass or sand beads called "carrier" and a black powder called "toner." It is in the developer that the basic principles of static electricity are employed.

The materials for the developer are selected for their triboelectric properties, that is, their ability to induce opposite charges of static electricity in each other when they are rubbed together. Having opposite charges, the carrier beads and

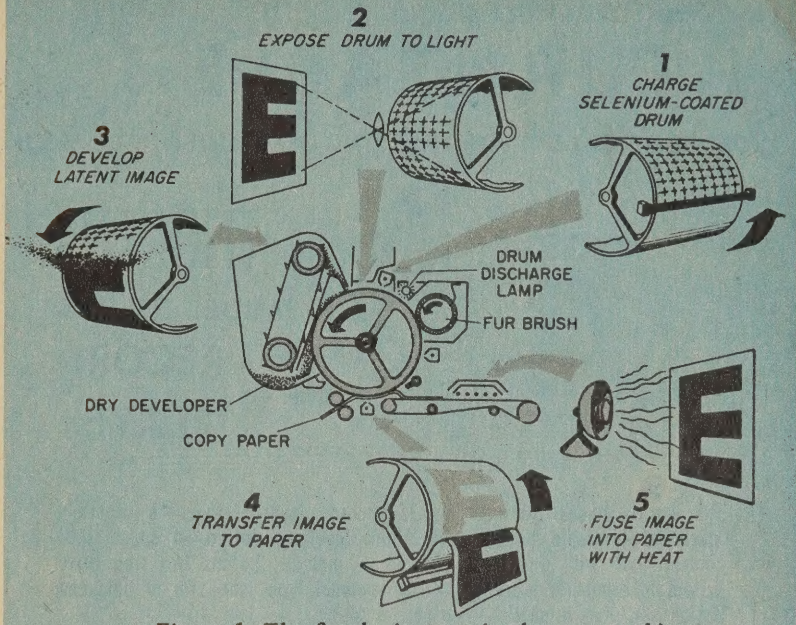

2
EXPOSE DRUM TO LIGHT
1
CHARGE
SELENIUM-COATED
DRUM
3
DEVELOP
LATENT IMAGE
E
DRUM
DISCHARGE
LAMP
FUR BRUSH
DRY DEVELOPER
COPY PAPER
E
4
TRANSFER IMAGE
TO PAPER
5
FUSE IMAGE
INTO PAPER
WITH HEAT

Figure 1. The five basic steps in the xerographic process are illustrated here. The plates are charged, exposed, and developed, and the image transferred to paper and fused.

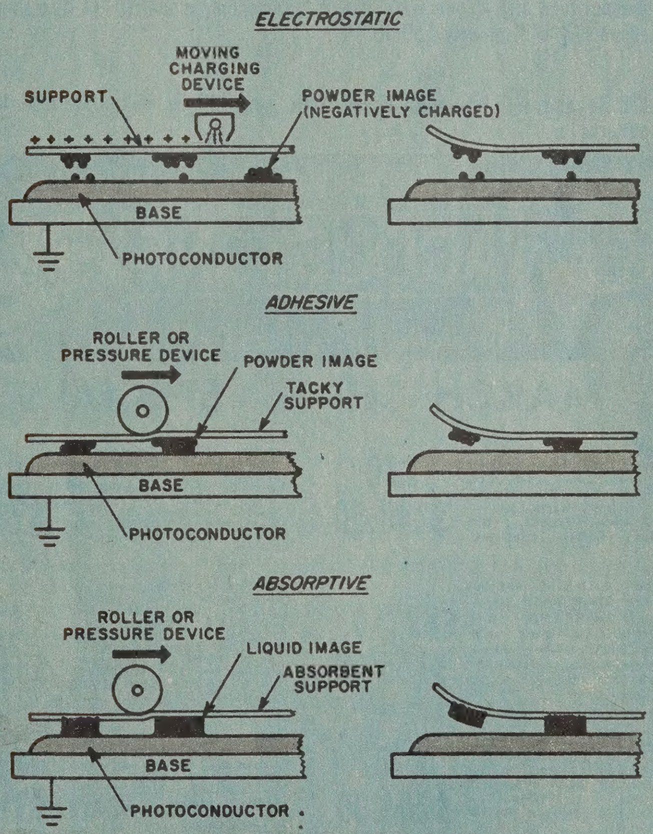

ELECTROSTATIC
MOVING
CHARGING
DEVICE
SUPPORT
POWDER IMAGE
(NEGATIVELY CHARGED)
BASE
PHOTOCONDUCTOR
ADHESIVE
ROLLER OR
PRESSURE DEVICE
POWDER IMAGE
TACKY
SUPPORT
BASE
PHOTOCONDUCTOR
ABSORPTIVE
ROLLER OR
PRESSURE DEVICE
LIQUID IMAGE
ABSORBENT
SUPPORT
BASE
PHOTOCONDUCTOR

Figure 2. Image transfer techniques. For electrostatic transfer the paper is given a charge opposite in polarity to that of the toner which makes the image on the photoconductor. The image is thus attracted or transferred to the copy paper. In the adhesive method the paper to which the image is to be transferred is coated with a sticky substance to which the toner adheres. In the absorptive technique the image on the photoconductor is liquid and when contacted by the paper, the liquid will then be absorbed directly into the copy paper.

thinking about a better
TURNTABLE ?
you can't afford to miss this bargain of the year

THORENS
MODEL TD 135
RECORD
PLAYER

The world famous Thorens TD 135 record player features—a precisely machined turntable and special inbuilt levelling device—4 speed shift control knob with disengage position — unique Thorens two step drive system to eliminate vibration — professional type tone arm of balanced design and plug in shell — variable 4 speed.

LIMITED STOCKS ONLY — SO HURRY! MARCH SPECIAL ONLY $110.00

Also available the Thorens single speed (33. 1/3) heavy duty model TD121 without tone arm at only $70.00 and the economy model TD111 also single speed (33 1/3) at only $50.00.

Call in and see this magnificent cloth, you will be delighted with the patterns.

The world's finest acoustic grille cloth!
ACOUSTONE
CHOOSE FROM OVER 20 PATTERNS
. . . the cloth with a thousand uses

MARCH HI-FI SPECIALS

Stereo Unit without cabinet. Tokai transistorised amplifier—GARRARD AT6 changer with SONOTONE 9TA ceramic cartridge — two WHARFEDALE 10in Bronze RSDD speakers. £70 $140.00

Stereo Unit without cabinet. PEAK TRM40 transistorised amplifier 10 watts per channel — GARRARD SP25 player — SHURE M44-7 magnetic cartridge, two WHARFEDALE 10in Bronze RSDD speakers . . £114 $228.00

Stereo Unit without cabinet. STAR SA30 amplifier — GARRARD AT6 player / changer with SONOTONE 9TA ceramic cartridge—two WHARFEDALE 8in Bronze RSDD speakers £82/10/ $165.00

Complete stereogram — comprising one control cabinet type 450, two SLIMLINE speaker enclosures — ROLAND FAX150 tuner/amplifier—DUAL 1010 HI FI player-changer — two WHARFEDALE 10in Bronze RSDD speakers £156 $312.00

Stereo Unit without cabinet. Star SA30 amplifier —GARRARD SP25 player — SHURE M44 magnetic cartridge — two WHARFEDALE 10in Bronze RSDD speakers £102 $204.00

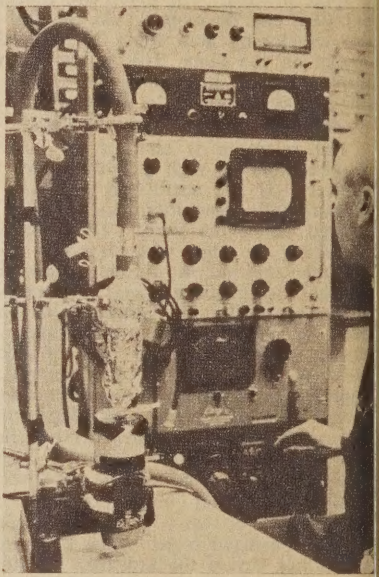
Stereo Unit without cabinet. PEAK TRM40 Transistorised amplifier—GARRARD LAB80 player — SHURE M44-7 OR M44-G magnetic cartridge — two WHARFEDALE Golden 10RS/DD speakers £157 $314.00

ARROW ELECTRONICS PTY. LTD.
NEW STORE FOR STEREO
432 KENT ST. SYDNEY. 298580

toner adhere to each other. The cha
on the toner is opposite to that wh
forms the latent electrostatic image
the plate.

As the developer cascades over
selenium plate containing the latent el
trostatic image, some of the toner is
lodged from the carrier beads by
combination of mechanical and electri
forces. It is captured by the elect
static field between charged and
charged areas, and collects on
charged portions of the image area. T
black toner forms a visible, but rever
reading, image on the plate.

The next step in the copying proc
consists of transferring this toner im
from the surface of the plate to a pi
of paper (or to almost any ot
material). This is done by placing
paper over the image area, then charg
the back of the paper with an electri
charge and bringing it in contact w



Determining charges of individual toner particles in developer. Powdered developer is vibrated in the particle generator (lower left) randomly freeing charged particles. Some particles are eventually drawn into the flow system and a detector picks up a voltage proportional to the particle charge. This voltage is displayed on the oscilloscope.

the selenium surface. The toner is th
attracted and transferred from the pl
surface to the paper.

We now have a right-reading ima
on paper, but the process is not yet co
plete. The toner is only lightly attract
to the paper and can be brushed
easily. It must be fixed. This can
done by fusing, that is, heating the pap
and toner so that the toner particles m
and bond to the paper. The image
now permanent.

Finally, the last procedure, cleaning,
not a part of the xerographic copyi
process but is necessary so that t
selenium plate can be used again
make more copies. There is a fai
residue of toner called a residual ima
left on the selenium surface after t

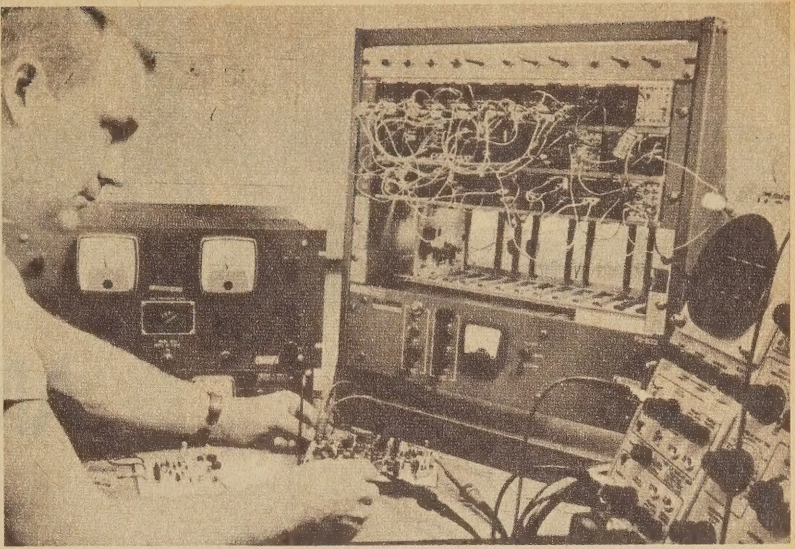
transfer step and it must be removed, usually by wiping with a soft brush, before the selenium can be re-used.

We have described a basic xerographic process, but there are many variations on each step of the process. For example, a corona discharge is not the only way to sensitise a plate. It can be charged in a radioactive source or by a conductive rubber roller. The plate can be exposed by contact, by reflection, by projection—or even by X-ray. The latent image can be developed by aerosols or by powder clouds, by liquid sprays or by immersion in a liquid. The image can be transferred electrostatically, as described, or by using an adhesive or absorptive transferring system (figure 2). Finally, the images can be fused chemically, by heat, by high-pressure rollers or a thin plastic coat can be sprayed over the image area (figure 3). In the zinc oxide and similar systems, the two steps of transferring and cleaning up are unnecessary; the image is fixed directly on the photosensitive paper.

After Xerox acquired the patent rights to xerography, the company set out to develop an office copier. The first commercial machine was announced in 1950. It was a manually operated machine consisting of several pieces. It had a corona device for charging a flat selenium-covered plate, a contact box with an optical system for exposing the plate to the image to be copied, a tray for cascade development, and an oven for heat-fixing the image. Each step was carried out separately and a good operator could make a copy in about two or three minutes. The company soon saw that it would have to speed up the process, automate it, and reduce the size of the equipment.

The process was automated and the speed increased by replacing the flat plate with a drum. The several process steps (charging, exposing, etc.) were arranged at locations about the periphery of the drum so that each process step could be carried out sequentially, but on different parts of the copy simultaneously. For example, while one part of the drum is being exposed, another part is being developed, the image is being transferred from another part, and the drum is being cleaned in still another part.

Reducing the size of the equipment was another matter. The first automatic machines were rather large and heavy—certainly not desk-top copiers.



A new transistorised circuit for a data display simulator is shown being checked in the company's laboratories.

In 1956, the company was firmly convinced that size was not the major consideration. What was important was the performance of the equipment, the ease and speed of obtaining copies, and copy quality. Hence, instead of concentrating on a small copier that could be built at a cost competitive with other desk-top copiers, it built versatility and long-run economy into a larger machine and concentrated on selling a copy service. This machine, developed and introduced in 1960, was called the 914 Copier (because the maximum copy size that the machine could handle was 9in x 14in).

Attention was next turned to the design of a true desk-top copier. The engineering plan called for a miniaturised version of 914. At first, the problems involved in shrinking the mechanisms of the 914 to about 1/7th of the size seemed almost insurmountable.

For example, more than 1,200 parts (not including nuts and bolts) had to be shrunk. The diameter of the drum had to be reduced from 8in to about 4¾in. The size and design of the drum cleaning system presented a problem in shrinking it down to size. An entirely new cleaning system using a new, soft, non-woven fabric was designed. Internal heat also became a design problem. The moving parts had to be much closer to the heating unit which fuses the toner. This meant that a new air-circulating system had to be designed to remove the heat, a system which would allow uniform fusing but would not disturb loose paper near the machine or make objectionable noise. These particular problems, along with a good many others, were solved and the 813 Copier was put on the market near the end of 1963.

The distinction between office copying and duplicating has always been that the duplicating process requires the preparation of an intermediate copy or master and copiers do not. For long runs, the cost per copy with duplicators is generally less than with copiers. In practice, duplicators are sometimes used to produce five or six copies (a costly operation) and office copiers are often used to run off copies by the hundreds.

The gap between copiers and duplica-

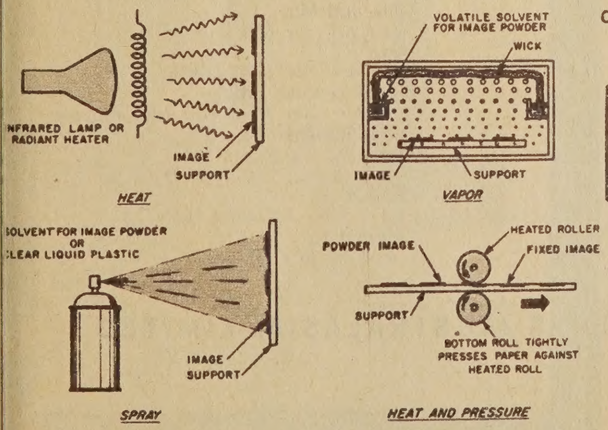
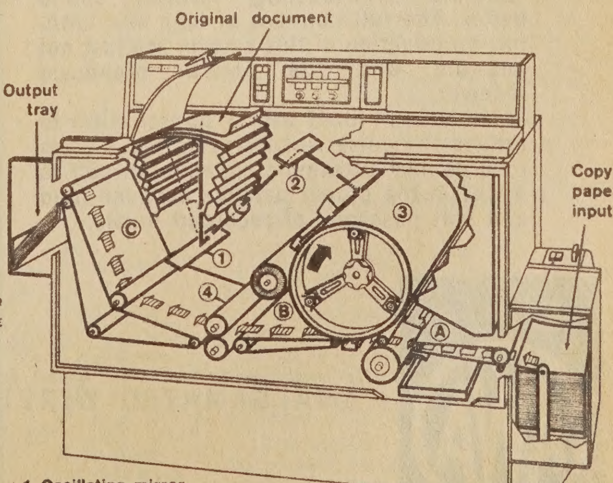


Figure 3. The various techniques that may be used to fix the image on the copy paper. Refer to text.



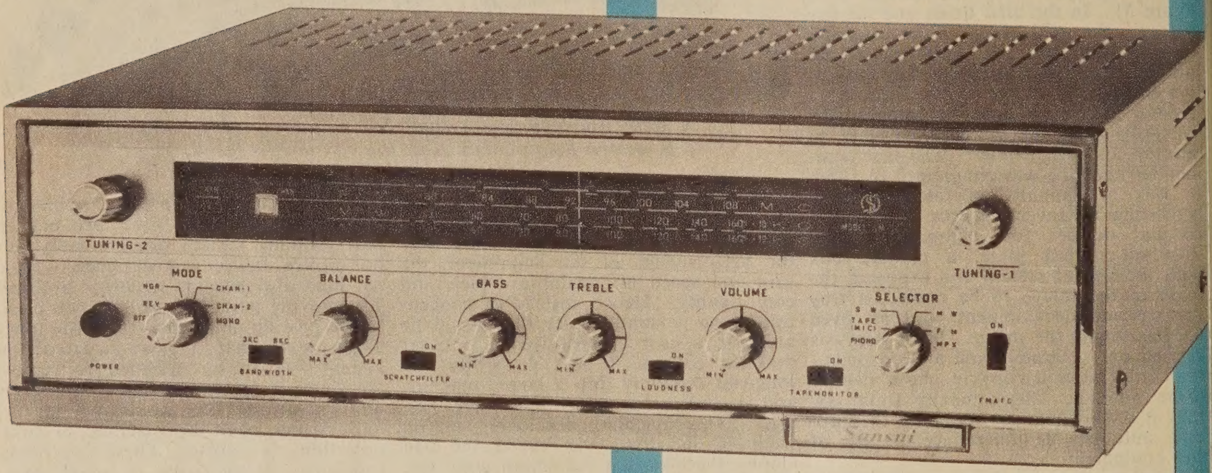
1. Oscillating mirror
2. Fixed mirror
3. Selenium-coated drum
4. Roll fuser
A, B, & C–Paper transports

Figure 4. The operating principles of the 2400.

Sansui

HI-FI STEREO TUNER AMPLIFIER

MODEL SM-34


TUNING-2
MODE
NOR
REV
OFF
CHAN-1
CHAN-2
MONO
POWER
3KC
8KC
BAND WIDTH
BALANCE
MAX
BASS
MIN
MAX
SCRATCHFILTER
ON
TREBLE
MIN
MAX
LOUDNESS
ON
VOLUME
MIN
MAX
TAPEMONITOR
ON
SELECTOR
S W
TAPE (MIC)
PHONO
M W
F M
MPX
TUNING-1
ON
FMAFC
Sansui

This is one of the best amplifiers to come from Japan, and, if used with a pair of A.W.A. bookshelf loudspeakers, type 1D94667, is capable of reproducing superb hi-fi programmes.

As well as the normal dual channel amplifier, the Sansui contains a dual channel tuner for stereo or dual reproduction of the standard broadcast band and a single channel for the reception of short-wave and FM sound.

With the Sansui, even programmes from standard broadcasting stations sound better. The full richness of tone and faithful reproduction of this system are just not possible with the normal broadcast receiver.

The SM-34 is fitted with a scratch filter to reduce the noise when playing those older records and a dynamic expander circuit to maintain the proper balance between loud and soft passages of recorded music.

BRIEF SPECIFICATION

Power Amplifier:

Output:
Max. 32 watts total; 16 watts per channel

Frequency Response:
—2 db. 20 c/s to 80 kc/s

Harmonic Distortion:
Less than 1% at 13 watts, each channel

Output Impedance:
8, 16, 32 ohms each channel

Pre-Amplifier Each Channel:

Sensitivity and Gain:

Gram. Pick-up:
Magnetic: 2 mV for 12W output
Crystal: 50 mV for 12W output

Tape and Mic.:
1.1 mV for 12W output

Aux.:
70 mV for 12W output

Signal-to-noise ratio:
Better than 55 db (at tape output)

Tuner Ranges:

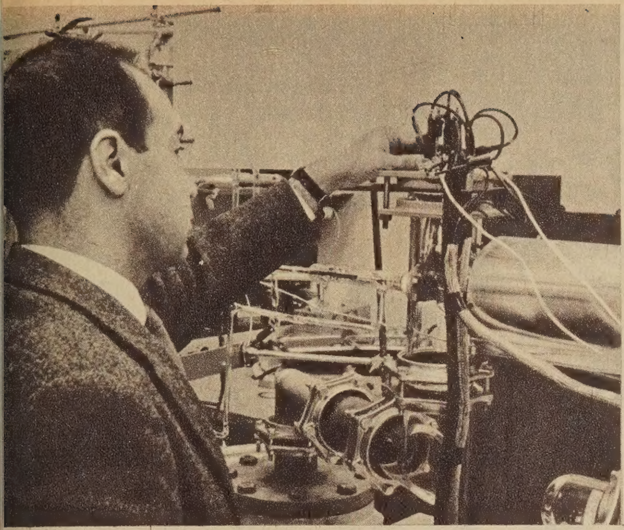
Channels 1 and 2:
AM B'cast 535 to 1605 kc/s

Channel 1:
AM S.W. 3.5 to 10 Mc/s

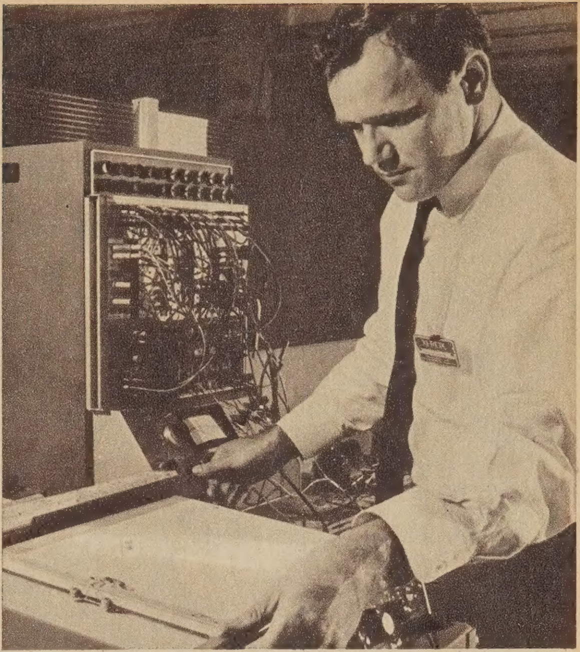
Channel 1:
FM 80 to 108 Mc/s

AWA

For further particulars please contact Engineering Products Division
AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED



The xerographic process relies on the deposition of electric charges on a selenium surface. These charges are generated by a corona discharge in air. The quadruple mass spectrometer shown here is used to analyse ionisation in corona discharge.



A small analogue computer is used by an engineer to simulate a control system for a copying machine under development. The mathematical model shortens test time and increases the confidence of the design.

tors was bridged with the introduction of the Xerox 2400. Copies are made with this unit at the rate of 2,400 per hour directly from the original document.

The original document is put on a curved glass platen and illuminated from below by a bank of specially developed fluorescent lights (figure 4). The document is then scanned by an optical system using a newly developed oscillating mirror. The image is reflected through a lens to a fixed mirror which, in turn, reflects each image on to a selenium-coated drum. The xerographic image is developed and transferred to the paper. It is then fixed permanently on the paper by a new method called "heated roll fusing."

To achieve speed, new developments were necessary in the optical, developing and fusing systems. In addition, drum speed had to be increased. The document image is placed sideways on each third of the drum, instead of the single image lengthwise on the whole drum. In the new fast-fusing process, the paper is squeezed between two rolls, one heated.

Xerography can be used with just about any electronic system where the electrical signal can be converted to light. It has, as a matter of fact, been used to produce documents from the outputs of radar, digital computers and seismic detectors.

As far back as 1950, there existed the capability to apply the principles of xerography in a system utilising a cathode-ray tube display to produce an image. However, existing transmission facilities were so limited that further development and applications to a long-range facsimile system were not practical.

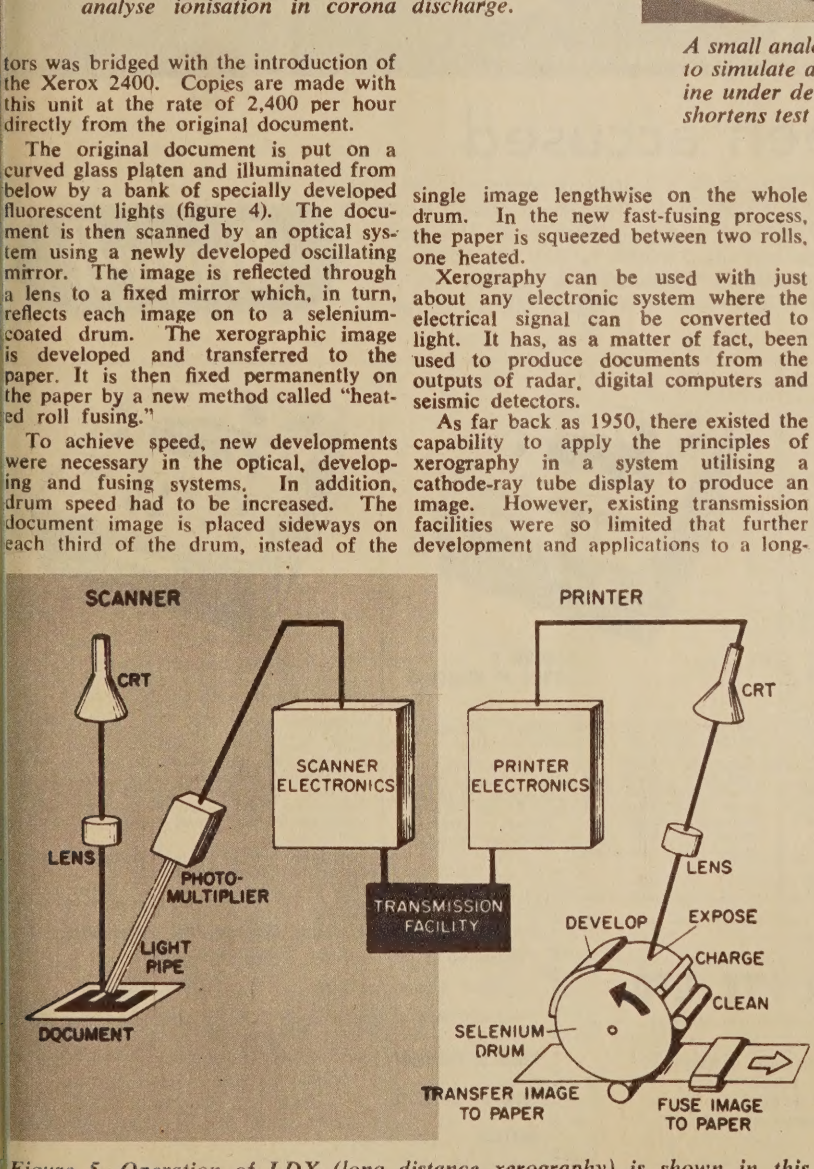


Figure 5. Operation of LDX (long distance xerography) is shown in this diagram.

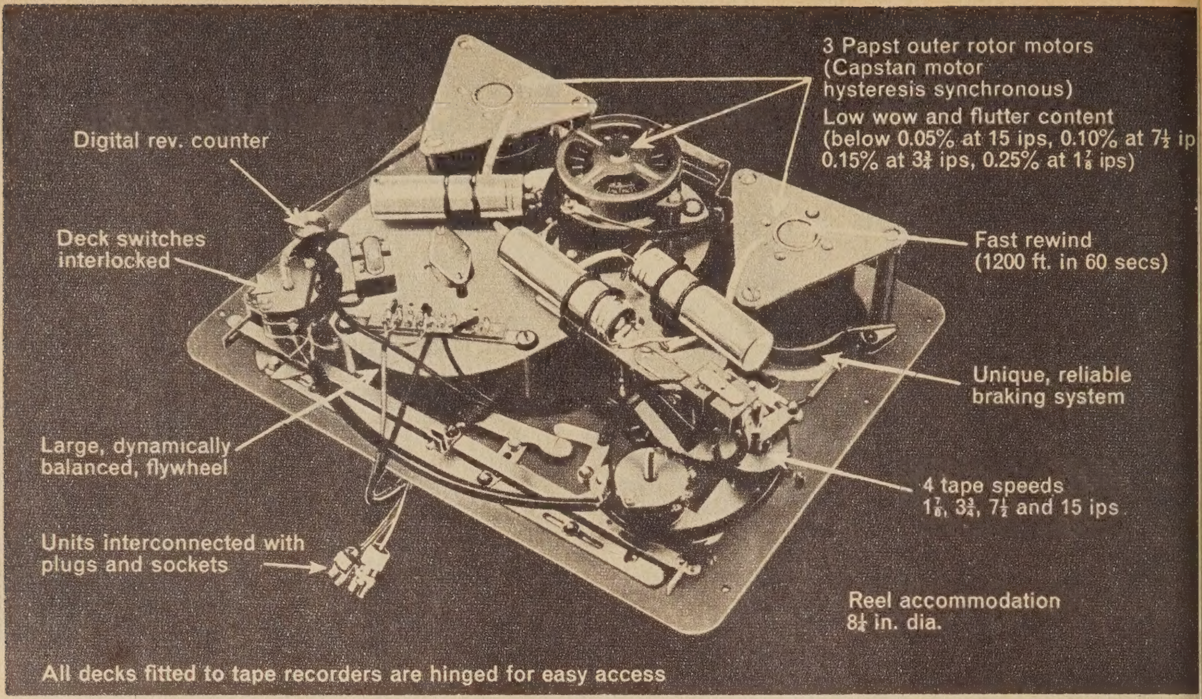
In 1961, development began on a system that would overcome the shortcomings of earlier facsimile techniques. A primary objective was to produce a system that would rapidly provide high-quality copies on ordinary paper.

In 1964, the first commercial long-distance xerographic (LDX) facsimile system was installed. This system, using a scanner and electronics, converts the image to be transmitted into two-level video signals for transmission over broadband facilities, such as microwave, special telephone lines, or cable (figure 5). On the receiving end, the signals are sent to a cathode-ray tube that projects them optically on to a xerographic drum. Then, they are reproduced by standard xerographic techniques.

Still in the research laboratory is an imaging method which is based on the deformation (selective wrinkling) of a thin film of plastic. Called "frost," the new method is inherently a continuous-tone process. A photoconductor is used to control the formation of an electrostatic image and the selective deformation of a heat-softened film. A light-scattering image is formed which can then be displayed by reflection or transmission optics.

One final application of the principles of xerography should round out our discussion. Xerographic toners are inert to most inorganic and to some organic etching solutions and, therefore, can be used as a chemical resist in the preparation of printed circuits. The technique can also be used to produce micro-miniature circuits.

These are but a few of the directions the research program has taken. The company intends to continue this emphasis on "directed research and development" and to push forward into new areas of graphic communication. ▬


3 Papst outer rotor motors (Capstan motor hysteresis synchronous)
Low wow and flutter content (below 0.05% at 15 ips, 0.10% at 7½ ip 0.15% at 3¾ ips, 0.25% at 1⅞ ips)
Digital rev. counter
Deck switches interlocked
Fast rewind (1200 ft. in 60 secs)
Unique, reliable braking system
Large, dynamically balanced, flywheel
4 tape speeds 1⅞, 3¾, 7½ and 15 ips
Units interconnected with plugs and sockets
Reel accommodation 8¼ in. dia.

All decks fitted to tape recorders are hinged for easy access

We have been accused . . .

of hiding the light of one of RCA's best lines under a bushel. So we have taken the hint and here it is in detail . . . a large illustration of the famous Brenell 4-speed Tape Deck, so you can see at a glance some of its principal features. This deck is used on all Brenell models and there are versions available to take 10½" NAB reels. We also supply tape decks and matching amplifiers separately for building into your own equipment cabinet. Post the coupon to RCA today for details of the Brenell range.

Brenell

THE BRENELL HI-FI TAPE LINK

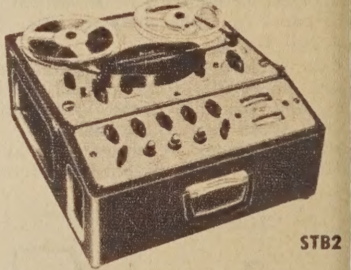
As most owners of High Fidelity sound reproducing equipment will know, tape recordings cannot be made from the amplifiers and pre-amplifiers by simply connecting a tape deck to the sockets marked record, a vital 'Link' between tape deck and amplifying equipment is required.

The Brenell Hi-Fi Tape Link contains twin recording amplifiers, "Push-Pull" Bias/Erase oscillator, twin playback pre-amplifiers and is designed for use with the Brenell three headed stereophonic tape deck, i.e., separate Erase, Recording and Playback heads (¼ or ½ track stereos) and any make of High Fidelity amplifying equipment capable of supplying a signal level from Radio Tuners, Microphones, Gramaphone Pickups, etc.

MARK 5
TYPE M SERIES 3

MONO-HALF TRACK—THREE HEADS—RECORDING LEVEL METER.

Separate record and playback heads—separate record and playback amplifiers—amplifier frequency response 25-26.000 c/s ± 3dB—power output 2 watts r.m.s.—separate bass and treble controls—mixing of input signals—speaker monitoring whilst recording.



STB2

MONO/STEREO—HALF TRACK (Record/Playback)—QUARTER TRACK (Playback). FOUR HEADS—EDGEWISE METERS.

Designed for use with high fidelity stereo installations—adjustable attenuators on all input channels—dual concentric recording/playback level controls — cathode follower output — 4-channel mixing on mono programmes — twin recording, twin playback pre-amplifiers—adjustable bias level—sound on sound facilities.

Optional extras: Stereo power amplifiers and monitoring speakers.

Sole Distributors:

RCA OF AUSTRALIA PTY. LTD.

An associate Company of Radio Corporation of America

SYDNEY: 221 Elizabeth Street. 61 8541.
MELBOURNE: 2 Stephenson Street, Richmond. 42 4586.
BRISBANE: 173 Ann Street. 2 7884.
PERTH: 280 Stirling Street. 28 5057.
ADELAIDE: Newton McLaren Ltd., Leigh Street. 51 0111.

Mail this Coupon to your nearest RCA dealer for further details.

Please send me detailed literature on:

☐ Brenell 4-speed Tape Deck
☐ STB 2 Brenell
☐ Brenell Mark 4 Type M Series 3
☐ Brenell Hi-Fi Tape Link

Name of Company ....
Type of Business ....
Address ....

RC.175.FPM

LARGEST INSURANCE OFFICE IS "WITH IT"

Coincident with the change-over to decimal currency, the Government Insurance Office of New South Wales has computerised all its records and transactions and provided ready access from regional offices to the data processing centre.

The G.I.O., the largest general office in the Commonwealth, carries third-party insurance for more than 90 per cent of all vehicles registered in New South Wales, a total of one million policies. In other fields it holds more than 500,000 policies throughout the State. It has a premium income of nearly $56 million (£28 million) and cash and invested funds of more than $148 million (£74 million).

This volume of business poses a tremendous problem in processing all the details of policies, claims, variations in terms and conditions, renewal notices, reminders and so on. In a small organisation teams of typists and clerks can handle the constant flow of insurance work, but the chances of human error increase as the business volume grows.

Computers were the answer to G.I.O. problems and investigations by its top executive showed that a fully computerised operation could be designed to process insurance policies and maintain a low ratio of costs to policies issued. The assistant general manager of G.I.O., Mr L. Carroll, says that the use of computers for general insurance work is still comparatively new—even in the United States—and that new ground was being broken by some G.I.O. applications.

The launching of G.I.O.'s data processing centre at Waterloo, Sydney, will give significant long-term benefits and cost-savings to the office, once the system is fully integrated. Apart from gearing-up to process its one and a half million policies on to magnetic tape with all other relevant material stored in the computer, the G.I.O. had to put into operation an effective communications network to enable its seven State-wide branches to feed material into the Sydney-based data processing centre.

The G.I.O. installed a Honeywell 400 system which includes a central processor; this performs the control and arithmetic operations. The central processor comprises 4,096 words, or 32,768 characters of memory with capacity to execute 10,000 operations per second. It contains a high-speed magnetic core memory, control unit, peripheral equipment and arithmetic unit and operator's console. The card reader, which is part of the system, can read punched cards at the rate of 800 a minute and can punch information on to cards at the rate of 250 a minute.

The magnetic tape unit can transfer information to the control unit at a speed of 96,000 decimal digits a second. The system has six of the units which records 800 decimal digits to the inch of tape. Computers are only able to operate on the information that is fed into them, but the Honeywell system has built into it a number of check points to guard against errors in recording. Echo checks verify that data has been printed correctly. The signals which control the driving of the print hammers are compared electronically with signals derived from original codes in the memory storage or the print storage buffers.

The magnetic tapes on which all policy records and other information is stored also have an error detecting and correcting feature. An error could occur through a small scratch on tape, but when the computer detects this error it points it out by back-reading. The missing piece such as a number lost from a figure can then be replaced by a single computer operation.

A typical transaction involving the Newcastle Branch office would proceed as follows:

A client is sold a fire insurance policy and pays the premium on the spot; the policy is typed out and handed to him for safe keeping. Copies of the policy are filed with the head office in Sydney where underwriters examine the policy and then refer it to the automatic data processing centre.

The data processing centre extracts information from the policy for transfer to magnetic tape. The information which is translated into computer code is transferred to punch cards and the proposal handed back to the fire department for filing. Cards are punched and verified from these details in the form of numbers and symbols and fed through the computer on to magnetic tape.

The full details of the policy are now on magnetic tape and, should nothing happen to the client's building, dwelling, etc., the computer will automatically produce a renewal notice for the client in a teleprinter written form ready for posting, two weeks before the policy becomes due for renewal. The automatic production of renewal notices by the computer saves time, not only in labour, thus reducing costs, but in typing, searching and checking records.

The whole insurance system is streamlined and automatic giving the client better and faster service and assisting in keeping the ratio of costs to policies issued down to a minimum. The G.I.O. already has the lowest ratio of costs to policies of any general insurance company operating in Australia—the computer installation will help in a most efficient manner to ensure these costs remain down.

With seven branches throughout New South Wales, G.I.O. management has found that telephone communications are the fastest and most economic means of transferring policy data on to the computer. Each of the seven branch offices has a telephone time-slot each day to communicate records on to the computer. A telephonist at a branch office phones through details to a clerk and this information in turn is put on to punch cards and fed to the computer.

The information and requests from the branches contain the numbers of the policies in question and the information sought. Punch card operators transfer this information on to transaction cards, one card being used for each policy. The cards are then fed into the computer and the installation's high-speed teleprinter produces in typed form the details needed for despatch to the branch office.

For instance a policyholder is involved in a motor accident. He reports the accident to G.I.O., the appropriate information being extracted from the claim of the client and produced on punch cards. The claim is verified by the computer and referred to G.I.O. assessors for inspection of the damaged vehicle. In the metropolitan area this assessment of damage would normally take place within two days of the reporting of the claim, representing a very substantial reduction in the time which might otherwise elapse before the claim is processed. ■

"Education" is one of the "three Es" aimed at road safety, and these pupils of Chatham school, Melbourne, start their driver education early at the Kew Traffic School. But like better highways, this alone is not the answer. Can electronics help?

ELECTRONICS AND ROAD SAFETY

By.
Prof. C. J. Milner*
and
E. Laisk, M.Sc.*

PART TWO

Following last month's discussion of special highways featuring electronic vehicle guidance and spacing, this month's article considers the next logical step: the provision of anti-collision devices on individual vehicles, making them independent of special highways. While somewhat controversial, many authorities believe that something like this is the only answer to the growing road toll.

An interesting and completely different approach to automatic vehicle guidance and control is contained in the patent[8] of J. Rabinow and partners. This employs optical means mounted on the car and features ability to function with almost no installation on or modification of the roadway.

Rabinow's invention employs an optical system which forms an image of the road and view ahead of the vehicle and a Nipkow disc or other TV device which scans a transverse line of this image, many times each second. The output of the light detector is recorded on a synchronised magnetic "memory" disc. During a subsequent scan, the output is compared with the memory; any deviations are detected and servo correction signals are provided accordingly by a computing circuit.

These servo signals are applied to the controls of the vehicle in order to keep its motion parallel to the roadway; and to take evasive action (braking) if, in the presence of other vehicles, a leading vehicle is approached so that its image expands. The electronic circuitry involves a ferrite memory disc, several recording and erasing heads, image scanner and light detectors, logic circuits, counters, code detectors, register and converters.

In a third and again-different approach, the authors have evolved a microwave radar unit for mounting on a vehicle which, pointed straight forward, will measure the relative speed of the vehicle ahead and also its distance.

This device is not intended to replace the normal driver, or to depend on special highways, buried cables, roadside computers, etc., although it could work in conjunction with these when they were available. Rather is it intended as a safety device capable of protecting a car, under normal traffic conditions, by always maintaining a safe distance between the car and other vehicles or obstructions.

Essentially, this system transmits two microwave frequencies, and any reflection gives rise, also, to two Doppler signals. However, these have very nearly the same frequency; and they produce a phase difference which is directly proportional to the distance between the two vehicles. Thus, this system measures the relative velocity, given by the Doppler frequency, and the range, given by the phase, simultaneously.

Voltages giving these data, and the ground speed, etc., may be fed to a computer which determines a "spacing error" and controls the acceleration accordingly. This radar uses the "diplex Doppler phase-comparison" principle[9] of W. D. Boyer. The spacing controller operates according to the principles indicated in figure 3. Some novel circuit details developed in this connection will be published elsewhere.

Microwave Doppler radar is most suitable for this type of use because microwaves will be reflected by just those objects sufficiently substantial and upstanding to be collision hazards; and because the continuous-wave or Doppler principle rather than the pulse-radar is best used at short ranges, with low powers, such as are involved between road vehicles. A survey of CW radar methods has been published by Nilssen.[10].

The most that electronic highways could do would be to maintain vehicles moving under automatic control in a single lane, and the possibility of overtaking is excluded. Therefore, all vehicles are limited to the speed of the slowest (including any one that stops!). If and when overtaking is to be performed and, in any case, at intersections, entrances or exits, control must revert to human drivers.

For automatic overtaking it would be necessary for the computing system:

(1) To check whether the adjacent lane is free of traffic ahead, beside and behind—and whether the "clear length" of that lane is suitable for overtaking.

(2) If so, to release speed and steering from the previous controls.

(3) To steer toward the adjacent lane.

(4) To pick up the new guidance signals and adopt steering control by them.

(5) To accelerate until overtaking has been effected.

(6) to return to the previous lane in a similar manner (steps 1 to 4).

It is very evident that this manoeuvre entails a degree of complexity in the controller far beyond the guidance-and-spacing controller discussed last month

Automatic overtaking can be performed only by an automatic system having ultimate reliability. At the present state of the art, the steps 2 to 4 in the overtaking manoeuvre have to be performed by the driver manually.

The automatic highway system also cannot respond constructively to "rogue vehicles" that stray out of lane, or to other foreign objects that may appear on the road.

In ordinary driving one is constantly encountering other objects besides the vehicles in lane or procession with one's wn. One pilots one's vehicle so that ese objects are allowed to come close ut are caused to pass clear. One does is when overtaking; one also, as entioned above, does this (and does it stinctively) when faced with a "dead-top" situation ahead.

---

* School of Physics
University of N.S.W.

For any anti-collision device that is be effective on ordinary, open roads, is essential to be able to control the anoeuvre of passing clear. For this urpose the relative motion, of the car be protected and the "target" which may hit, must be evaluated to deter-ine whether or not collision is predict-d — i.e. whether a hazard of collision xists, or whether the target will pass ear.

The essential element here is a mea-re of the transverse or angular rela-ve motion, because, when there is no ngular relative motion, the total rela-ve motion is purely radial. Neglecting e possibility that the radial or line-f-sight motion might be maintaining r increasing the separation, this means at the object in view is moving to-ards the observer and will in time col-de with him.

For an apparatus that (1) measures ngular relative velocity of each target), uses this measure to predict whether r not the target will pass clear, and (3) , and only if, collision is predicted, gnals what steering or braking anoeuvre will evade it, the general ame Imminent Collision Evaluator nitials, ICE) has been proposed[11].

This system is intended, firstly, merely indicate what action should be ken, leaving the driver to initiate this. owever, when the predicted collision me becomes less than the driver's re-ction time, the system will override e driver's instructions and initiate ap-ropriate action.

A ground-based ICE would have to valuate simultaneously the relative otions of many pairs of moving objects d would be many times more com-icated than an equipment mounted on, nd piloting, any one car. Besides, the eometry of the problem is much mpler for an "observer" moving with ne of the two objects, than for one ho observes both moving differently lative to himself.

In a vehicle-borne ICE explored by e authors, the beam of a radar as escribed (figure 3) scans in azimuth ead of the vehicle, and each obstacle bserved is recorded on a magnetic disc drum. The signal is replayed after actly one scanning period; if this is multaneous with a signal then being ceived, the two have the same bearing ngle.

Diverse systems have been outlined r collision warning on ships[12] and for rcraft[13]. However, in road traffic of ormal density, it is essential to allow more clearance than an amount refully computed according to the at-tude of approach; if both vehicles are d-on, much less clearance need, and ust, be allowed than if one or both side-on.

It has been shown [11] that full allow-ce for attitude can be made when, r each object, its distance, relative eed, bearing angle, and rate of change bearing angle are known, together ith the ground speed of the car carry-g the radar. In predicting "collision" "pass-clear," it is then assumed that oth vehicles are moving parallel to their long sides, with uniform speed, and in straight lines (except that a correction for steering angle of the radar car can be included).

In the ICE described above, rate of change of bearing angle is proportional in sign and magnitude to the time difference between the first (replayed) pulse and the second (received) pulse.

The object of prediction of collision is to evoke evasive action that disproves the prediction. One should not wait until collision is inevitable; neither should one act too soon when the prediction is still too uncertain. As time goes by, the imminence of the collision increases: the authors propose to measure imminence by the ratio:

$$I = \frac{\text{Relative speed}}{\text{Distance}}$$

the reciprocal of which is an estimate of the time, T, remaining before the collision (if any) occurs.

It is probably best to take evasive action when about two seconds remain, i.e., when I=0.5 approx. A direct measure of I is available in Boyer's radar (figure 3); the time interval between adjacent zeros of the two Doppler signals is directly proportional to T and inversely to I.

An ICE as proposed issues warning or control signals if, and only if, and when (a) the imminence exceeds say 0.5 and (b) the "incidence" then indicates "collision" rather than "pass-clear." The "incidence" is a measure of the predicted sideways displacement of the object during its approach and is given by the product of (i) distance, (ii) rate of change of bearing angle, (iii) imminence time (T) for that object. The sign of the "incidence" (which is the same as that of the rate-of-change of bearing angle) then indicates whether to "steer left" or "steer right" to evade collision.

If, and only if, simultaneous contradictory "steer" signals result, then a signal to "brake" is given.

Such a device would pilot a car safely, so that it never ran into any object, if the critical "incidence" were large enough, i.e. if it was made to give a sufficient margin of safety when passing.

If the equipment demands too great a clearance, the car will not penetrate

Figure 4. (Right). Block diagram for Imminent Collision Evaluator (ICE).

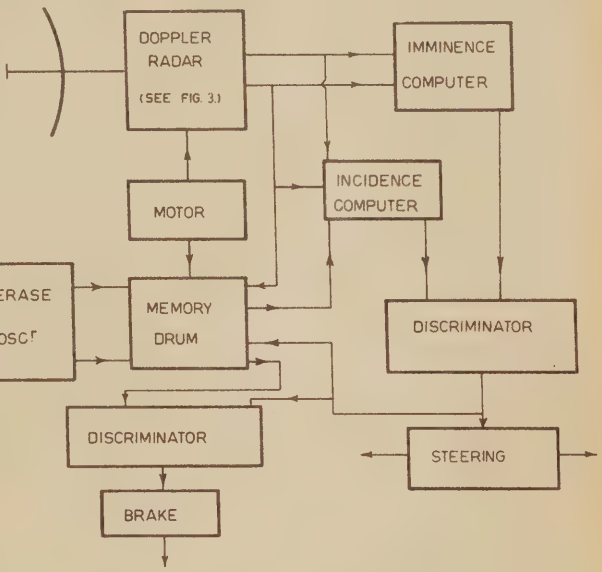
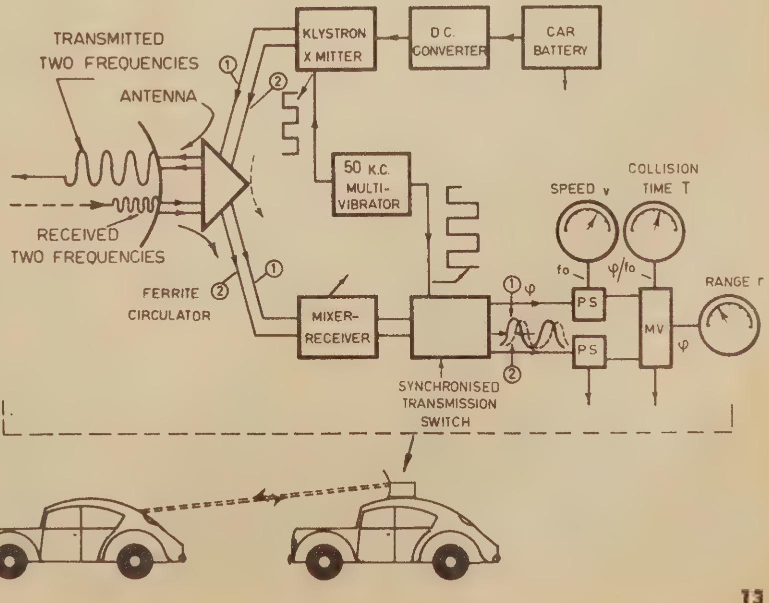


Figure 3 (Below). Block diagram of a simple vehicle mounted doppler system indicating relative speed (V), range (r), and collision time (T) of a "target vehicle."



They say . . .

C. G. Giles, B.Sc., O.B.E., Head of Human Factors Section, Traffic and Safety Division, Road Research Laboratory, West Drayton, Middlesex, England.

Taking into account the rapid progress being made in the electronics field and the versatility of the electronic devices themselves, it seems highly probable that in due course they may be able to play an important role in augmenting safety on the road.

It was with this possibility in view that the opportunity was taken when building the Road Research Laboratory's Research Track of equipping it with the necessary cables to enable full-scale experiments with electronic guidance and control techniques to be carried out.

Clearly we are not yet at the stage when electronics could provide the kind of "silent and reliable automatic chauffeur" which the authors of this paper envisage and it is hard to say when we shall be. The authors do, however, give a useful review of the position today and an interesting appraisal of some future possibilities.

Because of the importance they attach to the overtaking manoeuvre the authors are led to consider the possibilities of an "Imminent Collision Evaluator" (ICE). While there may be other and simpler schemes than this which also merit attention, it must be recorded that during a stay of a few months at the Road Research Laboratory one of the authors, Professor Milner, did, in fact, succeed in mounting a rotating radar system on a moving vehicle and obtaining signals from it as a first step in this direction.

W. W. Honnor, B.Sc., M.E.M.I.E. Aust., F.I.R.E.E. Aust., Chief Engineer, Amalgamated Wireless (Australasia) Ltd.

The paper commences with some fascinating statistics of the "traffic probabilities" of the average motorist driving on existing road systems.

The world research effort on road traffic safety and control is briefly reviewed and the authors raise the interesting point that for psychological reasons it is at least doubtful if there are worthwhile measures possible between conventional traffic of today and the completely automated electronic highway of the future. The latter would provide for (i) lane-keeping, (ii) overtaking and (iii) over-riding collision prevention in all circumstances. The first is relatively easy, the second somewhat more difficult, and the third becomes quite complicated. However, for some time there has been a word for the essential part of an electronic highway system—ICE standing for "Imminent Collision Evaluator" system.

The authors evaluate the logic requirements of their version of ICE, including provision for automatic braking; they conclude that such a device would need components and circuitry equivalent in number and complexity to a television receiver.

This paper will be of a great interest to a very wide range of readers. Although a small part of it is somewhat technical, most of it is sufficiently broad and simply expressed to appeal to everyone concerned either with roads or with motor vehicles. Today this means practically every adult and most of the teenagers. The first four paragraphs should be compulsory reading for every motorist and every legislator in Austalia.

APPENDIX

Figure 2 (published in Part 1, February, 1966) indicates a "Logic System for Spacing Control" in an electronic highway.

As a specific possible logic system, suppose that presence or absence of a vehicle in a block (A, B, C, or D) switches a current "on" or "off." The current from C passes to A and to B; that from D, to B and to C, etc. Also the current in each module changes a capacitor so as to measure and store the duration of each "on" period, say t seconds.

Signals then given according to the following table, having the usual measurings for the vehicle in the block, will maintain traffic flow and ensure freedom from head-to-tail collisions.

A SUGGESTED LOGIC FOR THE SYSTEM OF FIG. 2

When B changes to	If				Then SIGNAL
	C is	D is	(t_C/t_D) is	$(1.5 \times t_B)/(t_C + t_D)$ is	
On	On	On	Any	Any	"Red"
On	Off	Any	Any	Any	No Change
Off	On	Any	Any	Any	"Red"
Off	Off	On	Any	Any	"Red"
Off	Off	Off	<1	Any	"Yellow"
Off	Off	Off	>1	<1	"Yellow"
Off	Off	Off	>1	>1	"Green"

dense traffic. It is an exciting subj for research to see whether there is range of operation in which a c automatically piloted in this way, proceed both efficiently and with saf In such research, the procedure is record the decisions of the autom pilot, while a human pilot drives car, and progressively learns how conform with those decisions, while the time he remains responsible safety.

The use of the term "automatic pil here needs to be justified. Pilotage the ordinary sense includes two disti functions, which may be defined as destination-seeking or navigation, and collision-avoidance. It has become c ventional to describe as an autom pilot the equipment commonly used aircraft, which is really only an au matic navigator. ICE, as above descr ed, offers to take on the other half a pilot's job and to perform automa collision avoidance.

To bring a vessel, proceeding up buoyed channel, to its destination, pilot needs only to avoid collision w each buoy in succession and also evade (avoid collision with) any ot vessels or objects afloat in the chan Similarly, for a vehicle on a strai or curving road, pilotage requires o that obstacles in the road and suita placed markers—guide posts—be evaded. Destination-seeking is an act required only at occasional points, intersections.

While a complete auto-pilot syst for automobiles indeed involves an au matic destination-seeker as well as above automatic collision-avoider, former is a separate problem wh solution is not required for road safe One may imagine the passenger dict ing the route to be followed by press appropriate buttons, perhaps, as the v icle approached various intersections; the development of a central direct from which the best route from A to is furnished by radio to each car.

What is to be envisaged here is t an ICE-equipped car is as free to tra the open roads as any car with a hum driver. In the same way that it pil itself so as to avoid collisions with reliance on buried cables, roadside co puters, etc., and therefore on any ro whatever, it operates regardless of a restriction of traffic into lanes and c like a good human driver, judge itself when it is safe to pass or to ov take, to change lanes after overtaki etc. As observed above, it is highly certain that any of these manoeuv will be practicable for automatic p formance on an "electronic highwa and of course, vehicles operating au matically on an electronic highw would be unable to leave it and co plete any arbitrary door-to-do journey under automatic control. Ra door-to-door transportation at moment's notice is the great boon t the motor car has brought for t century: to adopt the electronic hi way for safety's sake would be to thr away this boon and to go back to 19th-century point-to-point railway.

An automatic collision-avoidan system, as set out above, can take ma different forms. One possible system indicated in figure 4. This uses the m netic-record "memory" device mention above Units marked "computer" de

(Continued on Page 19)

CELESTION "STUDIO SERIES" SPEAKERS

Both Celestion coaxial 12" models are proving very popular in Australia . . . and the price is more than competitive. The Standard Model CX1512 has a conservatively quoted frequency response of 30-15,000 c/s and is rated at 15 watts RMS. The Deluxe Model CX2012 (illustrated) has a frequency response conservatively quoted at 30-18,000 c/s and is rated at 20 watts RMS. Both models employ pressure type tweeters and feature an electrical crossover at 4 kc/s. See the reviews in "Electronics Australia," p. 131, Dec. 65, "Gramophone," p. 511, April '65, "Hi-Fi News," p. 75, June '65.

ENCEL PRICES

Standard CX 1512	$39.50
Deluxe CX 2012	$59.00

Cabinet construction details are available on request.

KELLY SPEAKERS

Now a subsidiary of the Decca group, the Kelly organisation have increased production and reduced the back-lag in supply to world markets. The technical know-how and financial resources of the Decca group assure rapid development and ever-increasing supply of Kelly Speakers.

The Mk III 12" Bass Unit. Performs very well in small enclosures up to 5 kc. Designed for use with the Kelly Tweeter. Encel price:

$39

The Kelly Mk. II Ribbon Tweeter is regarded as the most effective domestic tweeter ever available. Now only $39. Crossover to match .. $11. Encel prices make Kelly units an attractive buy for the enthusiast demanding superior speaker systems.

$39

KELLY 15" WOOFER UNIT

Designed for bass guitar and other woofer applications, the Mk. VII is rated at 50 watts. The voice coil is 2in diam. An excellent partner for the Ribbon tweeter. **$55**

TAPE RECORDERS

Advertising our tape recorder prices is forbidden; sufficient to say that Encel tape recorder sales are at an all time high! Write for your EMQ! Stock now includes: Revox G36, two and four track; Tandberg 64 and 74B; Beocord 2000 and 1500; Akai M8, X4, 355, 1700; Sony 500a, 200, 357-4, etc; National 703S, 705, 755S; Philips EL3548, EL3549, EL3301, Ferguson; Truvox and many more. **TAPE DECKS.** Write for prices of Collaro, Sony TC250A and Grundig TM45 tape decks.

TURNTABLES NOW IN STOCK

Orpheus, Labcraft, Garrard, P.E., Lenco, Thorens, J.H., Dual, etc.

THE NEW CELESTION "DITTON 10"

Regarded as one of the most advanced compact speaker systems ever to be released, the Celestion Ditton 10 is available in either teak or walnut oiled finishes. Frequency response is 35-15,000 c/s. See the reviews in "Electronics Australia," p. 131, Dec 65; "Hi-Fi News," p. 433, Oct. 65; "Gramo p. 41, June 65 Size of the Ditton 10 is only 12¾in x 6¾in x 8¼in. Encel Price **$59**

WHAT IS AN EMQ?

Many prices cannot be advertised, so we advise you to write for an EMQ — an Encel Mail Quote. When asking for prices on tape recorders and amplifiers we can supply your EMQ more easily if you provide us with an idea of the facilities and features required. Please give us your full address printed in BLOCK LETTERS.

KEF SPEAKERS

The new KEF "Celeste" with the improved "Super-tweeter" is now in stock. HF performance is considerably improved with this new tweeter. Write for an EMQ now on the new model KEF "Celeste."

AMPLIFIERS NOW IN STOCK

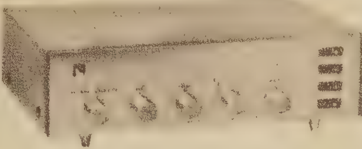
Leak, Lux, Encel, Pioneer, Trio, Roland, etc.

ENCEL X1212 STEREO AMPLIFIER

A new model of this popular amp. was released not long ago. Input sens. is 4mV, output is 12 watts in each channel. Frequency response is 30-50,000 c/s. **$89**

NEW CELESTION TWEETER UNIT

The Celestion HF1300 tweeter is now available in Australia. This unit is a development of the GEC BSC 1852 . . . which needs no introduction to hi-fi enthusiasts.. Frequency response is level within plus or minus 2db from 1500 c/s to 13 kc/s and extends well over 15 kc/s. Ratings quoted are conservative. Simply connected via a 10 mfd. capacitor. Popularly priced at . **$15**



THE LUX SQ11 . . . AUSTRALIA'S MOST POPULAR SOLID STATE STEREO AMPLIFIER

Users everywhere report excellent performance with this fully transistorised stereo amplifier. Input sensitivity is 4mV, output is 20 watts in each channel. Features include: Loudness control, scratch and rumble filters, separate bass and treble controls, etc. Send for full details. Similar quality is usually twice this price! .. **$139**

SPECIAL BUDGET STEREO SYSTEM

Pioneer SMB161 stereo amplifier with AM/AM/SW tuners, Dual 1010 hi-fi turntable, two 8in Goodmans wide-range speakers (or $185 with the Roland FAX150 amplifier) ——— **$199**

SPEEDY MAIL ORDER SERVICE

When ordering be sure to give your full address, printed in BLOCK LETTERS. All equipment is carefully packed to ensure safe delivery. All orders are dispatched promptly.

INTERCOMMUNICATION SYSTEMS

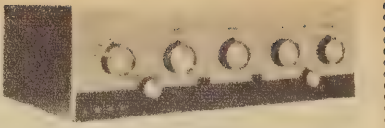
Four popular units are now in stock. Encel prices must prove interesting! Eden—7 station, $35.50. 4 station .. $27.50. Gem 3 station, $11.50. 2 station, $9. Ideal for the office or at home.

CAMERAS AND PROJECTORS

Encel Electronics now carries a selection of photographic equipment. The following terms are available ex-stock. All equipment is brand new and guaranteed.

COMPARE ENCEL PRICES

Projectors	Retail	Encel
Braun Paximat De Luxe N24	$159.00	$119.00
Braun Paximat Triumph	$94.00	$70.00
Leita Pradolux	$93.60	$69.80
Leitz Pradix	$49.15	$37.50



BUY YOUR "STEREO 30" NOW!

Encel trade-in prices on this remarkable LEAK amplifier are at their peak . . . so write now for an EMQ or a trade-in valuation.

TONE ARMS AND CARTRIDGES IN STOCK

Ortofon, ADC, SME, Shure, All Balance, JH, Pritchard, etc.

WHICH IS THE WORLD'S BEST AMPLIFIER?

Many claims have been made to this title . . . however leading overseas technical journals and their reviewing staff commend the quality of **ACOUSTECH** amplifiers, and many of them use Acoustech systems for personal listening. Encel Electronics are now Australian Distributors for Acoustech . . . write for full details.

DICTATING MACHINES IN STOCK

Philips 3582, Stenorette LWE, Olympia.

EXCLUSIVE ENCEL OFFERS FOR MARCH

1. Mullard 6GW8 4 watts per channel stereo amplifier in case, Labcraft 643 turntable with stereo diamond cartridge, two Wharfedale 8-inch speakers. An ideal budget system **$110**

2. The well known Star SA 30 stereo amplifier (or the new Encel X1212), Labcraft 605 turntable, JH tone arm, ADC 770 stereo diamond magnetic cartridge, two twin cone 10-inch Wharfedale RS DD speakers. (Richard Allen or Stentorian speakers may be substituted without additional cost). Priced at **$189**

   * With Sony TC250A stereo tape deck, 2 speeds, fitted with recording and playback amplifiers. Price **$335**

   * Supplied with Grundig TM45 3-speed, 3-head stereo tape deck (fitted with recording and playback amplifiers as used in the TK46). Price **$368**

3. Two Wharfedale "Linton" speaker systems, Labcraft 605 turntable, All-Balance tone arm and ADC 770 stereo diamond cartridge. Price **$215**

4. Leak "Stereo 30" fully transistorised stereo amplifier, two KEF Celeste speaker systems (with the new Super tweeter). Price **$380**

5. Orpheus Silex transcription turntable, Pritchard tone arm and ADC-10-E elliptical diamond cartridge. Price **$140**

6. Sansui Model 220 stereophonic amplifier with AM/FM/SW tuners, two KEF Celeste speaker systems. Price **$335**

7. Pioneer SMQ-300B stereophonic amplifier with AM/AM/FM/SW tuners, Orpheus Silex turntable, SME 3009 Mk II tone arm, ADC-10-E cartridge, two LEAK Sandwich speaker systems. For the connoisseur **$665**

8. New Garrard Lab 80 automatic turntable with ADC-660-E elliptical diamond cartridge. Price **$114**

EARLY ENCEL SPECIALS STILL AVAILABLE

The Special offers made from time to time by Encel Electronics in "Electronics Australia" (Page 15) are kept open for several months. In the majority of cases, the prices quoted are still applicable. Please check with us!

Encel Electronics

Head Office:
431 Bridge Road, Richmond, Vic. Tel. 42 3762
City Branch: 18 Bourke Street, Melbourne. Tel. 32 2672

PICK ANY NUMBER FROM 1S2 TO 12AX7 AND YOU'RE A WINNER!

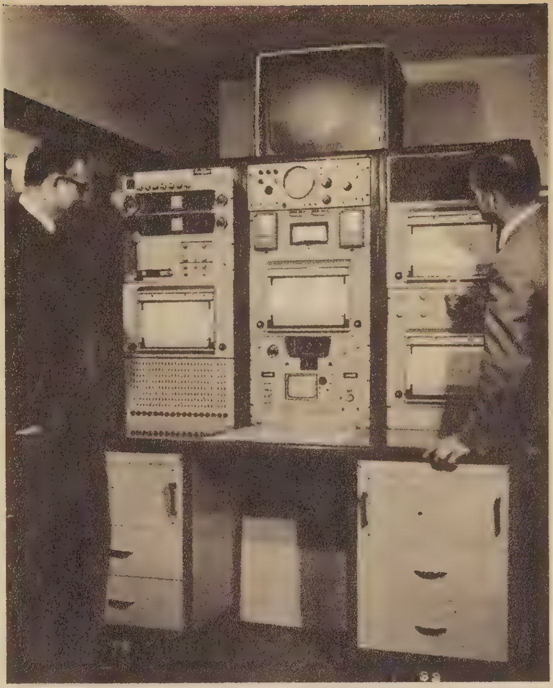
1S2
5U4G/B
6AJ8
6AK5
6AL3
6AL5
6AM5
6AM6
6AN7A
6AQ5
6AU6
6AV6
6BA6
6BE6
6BL8
6BM8
6BQ5
6BX6
6BY7
6CA4
6CA7
6CJ6
6CK6
6CM5
6CQ8
6CS6
6CW5
6CW7
6DX8
6EH7
6EJ7
6ES8
6FC7
6GV8
6GW8
6J6
6JW8
6M5
6N3
6N8
6U8/A
6U9
6V4
6V6GT
6V9
6X9
6Y9
12AT7
12AU7A
12AX7

. . . and on and on.

MULLARD-AUSTRALIA PTY. LIMITED, 35-43 Clarence Street, Sydney, N.S.W. 'Phone 29 2006. 123-129 Victoria Parade, Collingwood, N.5, VIC. 'Phone 41 6644.

Electronics and Market Research

Marketing researchers are making increasing use of electronic data processing and statistical techniques in their efforts to analyse and predict consumer responses. Pioneers in this fast-moving field are Audience Studies, Inc., who have developed a specialised analogue computer system capable of accurately predicting the success or failure of motion pictures, TV series, radio and TV commercials, live shows or even printed advertising. With installations already established in the U.S.A., Britain and Japan, this organisation has recently installed a new computer in Anzac House Theatre, Sydney.



Audience Studies engineers Ralph Wells (left) and John Appleton supervising final testing of the newly-built computer at Anzac House, Sydney. Mr. Wells originally designed and developed the computer system at the ASI headquarters in Los Angeles.

Audience Studies, Inc., had its be-
ning some six years ago, when Screen
ms, the television production division
Columbia Pictures, Inc., formed a
ision designed to investigate TV
wer reactions in the U.S.A. Under
guidance of Pierre Marquis, now
eral manager of ASI, Screen Gems
lved a system of pre-testing television
grams in a theatre environment using
ombination of measures, including a
nputerised instantaneous recording of
e-dislike reactions, more orthodox
estionnaire forms and small-panel
us group interviews conducted by
chologists.

This enabled Screen Gems to predict
h a considerable degree of accuracy
"success" or "failure" of a TV pro-
m series in terms of national Nielsen
gram ratings. (Nielsen ratings are
ained through devices which record
channel viewing habits of a repre-
tative sample of homes throughout
viewing area.)

Subsequently, ASI broadened con-
erably the basis of their testing ser-
es, paying increasing attention to the
commercial pre-testing field. The
heatre testing technique was extend-
and applied to advertising research
well as to evaluation of television
grams and motion pictures. Today,
ile pre-testing of TV commericals is
of the major areas of activity, the
mpany claims to have had consider-
le success in the testing of radio com-
rcials, printed advertisements, pro-
tions and packaging.

The in-theatre commercial test labora-
y is not in itself a new idea. How-
r, the application of rigid controls
the use of specially designed equip-
nt to measure attitudes of the test
dience have resulted in major ad-
nces in the research measurements
vided by such laboratories.

Testing audience members are select-
in the field through personal inter-
ws in no fewer than 30 pre-deter-
ned locations in the sampling area—
this case, Sydney. Test audience
aracteristics and quotas are determin-
from population census data projec-
ns. As each testing session requires a
npletely new, carefully controlled
nple audience, selection is a time-con-
ning and costly process; however, it
is necessary if the test results are to have the desired prediction accuracy.

The testing is done at Anzac House Theatre, Sydney, with test audiences of between 250 and 300 people. The test session itself contains numerous checks to determine whether the reactions of the test group are comparable with responses of previous audiences to the same material. Altogether, three standardised audio-visual items are used as control material; one is a commercial. In addition, checks exist to determine the degree of audience fatigue during the evening, the degree to which they reflect a sample with "typical" viewing habits, and so on.

On occasions in the longer-established ASI operations in the U.S. and U.K., material from entire test evenings has been discarded due to atypical responses of an audience or its distorted composition in terms of demographic characteristics. An outstanding example was at the time of President Kennedy's assassination, when for several weeks audience responses to the "controls" were either unduly depressed or exaggerated so that the findings of these tests were found to have low accuracy. (They were outside established tolerance limits.)

DULL
VERY DULL
VERY GOOD

Audience members record their reactions via hand dials.

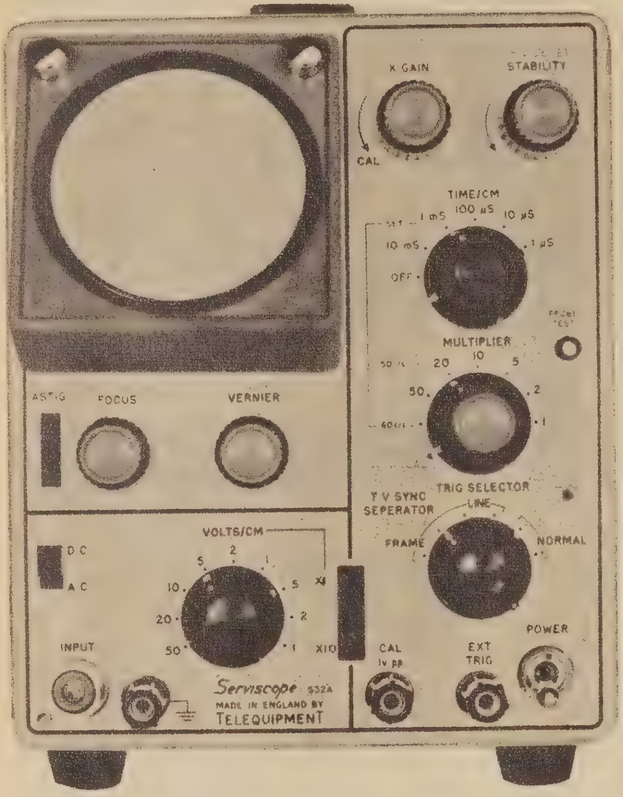
During the testing session, viewers in the audience manipulate a dial mechanism indicating on a second-by-second basis their degree of interest in the commercial or film. Their responses are fed into a specialised analogue computer which instantaneously not only scans the reactions of each individual viewer but also aggregates, averages and graphs the reaction curves of the total audience. Curve patterns derived from the computer clearly indicate points in the commercial, film, etc., that stimulate audience interest; they also reveal sequences that generate neutral or negative responses.

In addition to the computation and charting of the total audience reactions, the computer is capable of averaging and charting separate results for specific sub-groups within the audience (males v. females, younger people v. older people, users of a certain product v. non-users, and so on). This is done through special programming of personal characteristics of individual members of the audience into the computer by means of IBM cards. The provision of sub-sample findings is particularly valuable as a diagnostic tool for evaluating creative aspects of advertisements.

A further analysis provided by the computer is a graph showing the instan-

TELEQUIPMENT Serviscope

MODEL S32A a precision measuring oscilloscope



SPECIFICATIONS

Y Amplifier	DC-1Mc/s: 10mV/cm DC-10Mc/s: 100Mc/cm Rise Time 35 nanosec.
Attenuator	9 position freq. comp. 10mV to 50V/cm
Time Base	18 pre-set speeds 1-500 uS: 1-500mS/cm
Expansion	Variable up to 10 x
Triggering	Automatic up to 1Mc/s for repetitive sigs. Control selects any point on slope for repetitive, random or single shot. Selects +ve, −ve, TV line or frame. Ext. or int. HF trigger for high freqs.
C. R. T.	3" flatfaced PDA: 3.5KV
Power	90/250V: 50-100 c/s
Size	13¾" x 8" x 6½":
Weight	16lbs.

PRICE: **$262-00**

plus 12½ per cent S.T. NETT F.O.R. Sydney

Incorporating a 3in spiral PDA flat-faced tube, specially developed for Telequipment and operating at 3.5 KV, the S32A is capable of fast pulse work normally expected only of far more elaborate instruments. This widens the field of application considerably, taking in, besides servo mechanisms, transistor circuits, guided missiles, computers, television and radar development, production and maintenance, such advanced applications as electro-mechanical, medical and biological work. All the familiar Serviscope features are retained in this new oscilloscope . . . wide range time bass, D.C. coupled amplifier, time and voltage calibration, unique triggering arrangements . . . plus extra-wide bandwidth of 10Mc/s with a new 10 x gain facility over a limited frequency range. Normal sensitivity is 100mV/cm over 10Mc/s; with x 10 gain, sensitivity becomes 10mV/cm over 1Mc/s. The S32A will operate from a 110 or 200/250V supply. On the back of the cabinet terminals give access to the X amplifier input, sweep output and CRT cathode for Z modulation. A camera attachment and a Hi-Z probe are available as extras.

The Serviscope range is playing an increasingly useful role in the world of electronics. The Serviscope was the first oscilloscope to bridge the gap between large, elaborate, expensive instruments of extreme accuracy, and portable instruments of such limited performance as to be little more than indicators. Each model of the Serviscope is developed with the current needs of industry and research in mind . . . and each has earned an extremely high reputation in all parts of the world.

JACOBY, MITCHELL & Co. Pty. Ltd.

469-475 KENT STREET, SYDNEY (26-2651)

MELBOURNE:
15 ABBOTSFORD ST.,
NTH. MELBOURNE.
(30-2491-2)

ADELAIDE:
372A SOUTH ROAD,
GLANDORE. (53-6117)

BRISBANE AGENTS:
T. H. MARTIN P./L.,
WILSON HOUSE,
CHARLOTTE ST.
(2-1785)

PERTH AGENTS:
C. F. LIDDELOW & CO.,
239 NEWCASTLE ST.,
PERTH (28-1102)

TASMANIA AGENTS:
K. W. McCULLOCH P./L.,
P.O. BOX 606G
LAUNCESTON (2-5322)

eous distribution of preferences oughout the audience. Thus it is pos- le to determine at any point in the t program the proportions of viewers istering favourable, unfavourable or ıtral reactions.

The applications of the computer and techniques are not confined to the ting of finished commercials, as men- ned earlier. For a number of years company has been successfully test- filmed storyboard commercials. odels and presenters of products in mmercials, promotional ideas, recipes l advertising concepts. The testing of nted advertising has also been proven ccessful utilising the in-theatre tech- que.

After an exhaustive series of experi- ntal tests in London, a method of ning the advertisements within a mework of two or three control ads s developed. Application of slightly odified measurements to this type of t was found satisfactory, and this hnique is now being introduced by all I offices.

The results of these applications of a processing and statistics to market earch are impressive. In the U.S.A. dience Studies have been highly suc- sful in predicting the audience ratings television programs and box office ings of motion picture films. For ample, of the 58 films tested by the mpany over the past three years cor- t predictions were made for 53 of se—an accuracy of 91 per cent.

In the area of TV programs, two of three major U.S. networks (NBC d ABC) are testing through ASI most of their program pilots—to give guidelines for purchase. They also test many episodes of already scheduled series to determine the most effective scheduling pattern.

Test audience members are selected from the population using tightly controlled sampling techniques. On arrival at the theatre, they are seated according to a pre-established plan.

Market researchers such as ASI are constantly looking for improvements and new developments in the tools they use. During the past year a major technical breakthrough was achieved by ASI engineers in the development of a Basal Skin Resistance Multiple Recorder.

The operating principle employed here depends on the well-known observation by doctors and psychologists that changes in subconscious and conscious emotional responses are reflected physiologically in changes in the electrical skin resistance of an individual. The testing system by monitoring skin resistance is able to measure subconscious emotional reactions of large samples of respondents, in much the same way as the hand dials record conscious responses.

The recording device consists of two finger electrodes attached to a "wristwatch" containing miniaturised electronics. Each set is connected into the central recorder, which graphically presents two composite readings of the subconscious responses of the group.

The new equipment is currently being used by ASI in America and Britain for testing television commercials and printed advertisements. In a large number of experimental projects this equipment has also proved itself most successful as a sensitive measuring device of subconscious reactions to alternate colour selections, alternate package designs, and to proposed consumer premiums.

There is evidence that such "autonomic" responses are more discriminating than preferences expressed by means of standard questionnaire techniques. They have also been shown to provide valuable data to supplement the conscious responses to films and TV programs.

Audience Studies plan to introduce the use of this equipment in all appropriate areas of pre-testing in Australia during 1966.

ELECTRONICS & ROAD SAFETY

(Continued from page 14)

"imminence", I, and the "incidence", from the distance and speed data en by the radar and the angular speed tained by comparing the direct and corded radar pulse envelopes. The m "computer" here should not be sunderstood; essentially these units are more than analogue multipliers.

The imminence and incidence outputs to a "discriminator" which in turn livers an output if (a) I is greater than and (b) P is less than Po. Io is a nstant, as above described: in a pos- le system[11] Po has one or other con- nt value according to whether the aring angle (determined from the sition of the radar head in its rotation) d the angular speed have the same or posite signs.

As indicated above, the discriminator tput actuates the steering, left or right cording to the sign of P. It is also en in Fig. 4 that this output is record- A second discriminator receives both ect and recorded "steer" signals, and ponds if two contrary "steer" signals given within, say, one scanning riod . On this response, the brake is plied.

An analysis of the complex details of h a system has indicated that the ıctional components are similar in mber to those of a television receiver. r ample reliability, it may be neces- y to duplicate or triplicate all units. aring in mind the large-scale appli- ion that may be envisaged, and that components (with the possible excep- n of the microwave generator) may constructed using only solid state de- es, the presently-substantial cost may be anticipated to decrease greatly within years.

Indeed the present trend towards integrated circuits and micro-miniaturisation[14] gives every reason to expect that fantastically compact, reliable and cheap automatic-pilot electronics will be forthcoming, their cost being quite negligible once power steering and power brakes are installed to be actuated by the automatic system.

Who, however, would not pay some amount for a silent and reliable automatic chauffeur to convey him safely through traffic snarls such as our cities now inflict on us? What is the value of such a device in terms of peace of mind, even if, at least in its early years, it is a bit ultra-cautious?

REFERENCES

8. U.S.A. Patent 3,182,496 of 9th March, 1965.
9. W. D. Boyer: A Diplex Doppler Phase Comparison Radar; IRE 1962 Convention paper.
10. O. K. Nilssen: New Methods of Range Measuring Doppler Radar; IRE Transactions ANE-9, Dec. 1962.
11. C. J. Milner: Collision Warning Devices for Road Vehicles; IRE Aust. 1963 Convention preprint.
12. H. R. Whitfield and C. M. Cade: A Mathematical Analysis of Collision-Course Prediction by Doppler Radar; Proc. IEE July 1958.
13. Y. J. Liu and J. O. Campbell: Collision Detection Without Range Data; Electronics, July 24, 1959.
14. E. Laisk: Micro-miniature Circuits; ELECTRONICS Australia, Aug. and Sept., 1965.

1967 I.R.E.E. CONVENTION

The Institution of Radio and Electronics Engineers Australia announces that the 1967 convention will be held at the new Qantas Wentworth Hotel, Sydney, from Monday, 22nd May, to Friday, 26th May.

The Qantas Wentworth Hotel is presently under construction and is due for completion late in 1966. It will be Australia's most modern hotel, designed to equal the finest world standards and especially equipped to provide every facility for a convention.

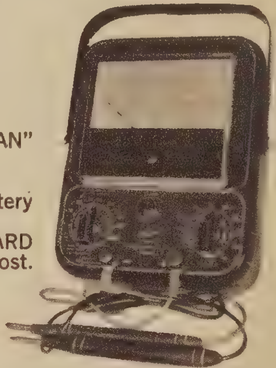
It is anticipated that the display of equipment at the 1967 Convention will be the largest ever, with exhibits typifying the latest advances in electronics and communications engineering. The technical program will include practical research and review papers.

Multimeters and Test Equipment

32 SERIES MULTIMETERS

with Taut Band Suspension & Diode Overload Protection

MODEL: M32A	MODEL: MX32	MODEL: MXL
D.C. 1,000 Ohms/Volt SPECIAL PRICE £13.17.6 ($27.75)	D.C. 20,000 Ohms/Volt SPECIAL PRICE £17.17.6 ($35.75)	D.C. 40,000 Ohms/Volt SPECIAL PRICE £19.17.6 ($39.75)



RANGES:

VOLTS:	A.C. & D.C. to 1,000V.	(10 Ranges)
CURRENT:	D.C. to 10 Amp	(9 Ranges)
OHMS:	to 10 Megohms	(3 Ranges)
	Decibel Ranges	(6 Ranges)

FEATURES:

- New Indestructible Clear "LEXAN" Cased Meter.
- 2 Terminals only.
- Enclosed easily accessible Battery Compartments.
- 3-feet Test Leads fitted with HARD RUBBER PROBES at no Extra Cost.

MODEL OM2 OHMMETER: Price: £12.10.0 ($25.00)

(N.S.W. Dept. Mines Approval No. MDA/82 for Detonator Testing)

RANGES:

4 Ranges Covering 0.05 to 100,000 Ohms.

APPLICATIONS:

Earth Continuity Testing—House Wiring Appliances
Resistance of Transformer & Motor Winding Heating Elements, Etc.

64 Series MULTIMETER

with Relay Circuit Protection also Taut Band Suspension

Model MX64A 20,000 Ohms/Volt D.C. Price: 42 gns. ($88.20)

(Redesigned 1965)

RANGES:

Similar ranges to Model MX32 (see above) but with additional ranges of A.C. Current to 10 Amperes, A.C.-D.C. Volts to 3,000 and Ohms to 50 Megohms (MX64).

Send for Leaflet.

FEATURES:

- Press-button Reset Overload Cut Out Relay.
- Single Knob, Two-terminal Operation (to 1,000V.).
- 6-inch Mirror-scaled Meter.
- Semi-hard Rubber Housing.
- Accessible Battery Compartment.

The PATON PA2 POWER ANALYSER

A true Dynamometer—Indispensible for Production Testing — Plant Maintenance — Trouble Shooting — Motor and Sealed-Unit Diagnosis.

RANGES:

Volts A.C.: 0/125, 250, 500.
Amps A.C.: 0/2, 5, 20.
Watts A.C.: Nine Ranges—three for each Voltage Range.

PRICE:

£29.17.6 ($59.75). Including Break-in Connector.
STAR RESISTANCE BOX FOR 3-Phase Testing, £4.5.0 ($8.50) Extra.

* All Paton Instruments are Made IN Australia and backed by on-the-spot service.
PRICES quoted are plus 12½% Sales Tax. TERMS AVAILABLE. Write for details.

Established over 25 years

PATON ELECTRICAL PTY. LTD

90 VICTORIA STREET, ASHFIELD, N.S.W. 71-0381 (6 lines)

Agents:
N.S.W.: Warburton Franki Industries Pty. Ltd., 307-315 Kent Street, Sydney.
VICTORIA: National Instrument Co. Pty. Ltd., Melbourne Airport, Essendon.
SOUTH AUSTRALIA: E. Bown Pty. Ltd., 21 Tom's Court, Adelaide.
QUEENSLAND: K. H. Dore & Sons, 505-507 Boundary Street, Brisbane.
WEST. AUSTRALIA: Henderson Instrument C Pty. Ltd., 309 Hay Street, Subiaco, Perth.
TASMANIA: George Harvey Electric Pty. Lt 76 York Street, Launceston, and 22 Patri Street, Hobart.
NEW ZEALAND: Turnbull and Jones Lt 12 Courtenay Place, Wellington. Branch throughout N.Z.

Technical Review

AUTOMATIC TRAIN WEIGHING WITH LOAD CELLS

An article in our March, 1965, issue (Electronics Solves Weighing Problems) explained how load cells are used in industry for certain weighing applications. The following article extracted from the Hawker Siddeley Technical Review explains how load cells are used for weighing railway waggons while they are on the move with a system known as "Railweight."

RAILWEIGHT is an automatic weighing system which possesses e unique ability of weighing railway aggons in motion at speeds of up to 3 mph. The overall accuracy of the ystem is about 0.1 per cent. The wagons to be weighed pass over a strengthned section of track, designed to reuce vibration to a minimum before nning over a weighbridge which consts of railway lines mounted so that e axle loads are transmitted to load lls. The electrical outputs of the load lls are used as inputs to electronic rcuits which provide a visual and a rinted display of waggon weights. The quipment has built-in calibration ciruits and provides an alarm if the maxium speed for accurate weighing is exeeded. It is capable of bi-directional eighing and is robust and easily mainined.

The advantages of such a system inlude:

(i) Any or all waggons can be eighed without stopping the train and ncoupling the waggons to place them ngly and laboriously on the normal atic weighbridge.

(ii) Waggons of any length or load can be weighed, since the weighing is carried out axle by axle.

(iii) Up to 800 waggons an hour can be weighed by one man using Railweight, whereas using traditional weighbridges three to six men are required to handle 60 to 70 waggons an hour as a maximum. Experience in the United States of America, where eight Railweight equipments have so far been installed, indicates that weighing costs may be reduced from an average of 14 dollars per waggon to as little as 10 cents a waggon representing a saving of over 99 per cent.

WEIGHING CORP.
MMONS WEIGHING STATION

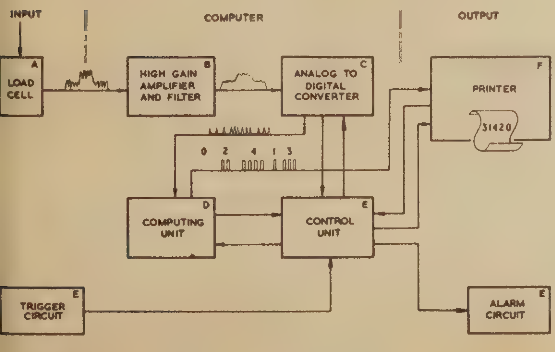
A train passing over the automatic Railweight weighbridge is weighed waggon by waggon to an accuracy of 0.1 per cent.

For high reliability, the electronic equipment is solid state throughout and is built on the basis of plug-in modules as far as is possible, for ease and simplicity of fault-finding, which can be carried out to module replacement level by relatively unskilled personnel. Routine maintenance has been reduced to a minimum and the equipment requires only calibration and servicing twice a year.

The basic units are:

(a) **The load cells**

A robust strain-gauge load cell is used in a bridge circuit in such a way that when the load cell carries a load due to the weight of a moving



Block diagram of Railweight electronics

LAFAYETTE *Newest 9-Tube*
AM/CW/SSB Amateur Communications Receiver
Model HA-230

Supersedes the famous HE-30

4 BANDS : • 550-1600 KC (Broadcast Band) • 1.6-4.8 MC • 4.8-14.5 MC • 10.5-30 MC **$159.50 (£79/15/-)**

Successor to the popular HE-30, the new HA-230 features improved performance and attractive modern styling to make today's best value receiver buy backed by LAFAYETTE'S exclusive money-back guarantee.

NEW "ALWAYS ON" FILAMENT VOLTAGE FOR MIXER AND OSCILLATOR STAGES GIVES SUPERIOR FREQUENCY STABILITY.

- 8 Tubes plus Rectifier Superhet Circuit.
- 1 RF plus 2 IF Stages for High Gain Reception.
- Easy-to-Read Illuminated Slide-Rule Dial.
- Built-in Q-Multiplier for Crowded Phone Operation.
- Antenna Trimmer for Optimum Performance on All Bands.
- Calibrated Electrical Bandspread on Amateur Bands 80 to 10 Metres.
- 0-100 Logging Scale for SWL's.
- Effective Automatic Noise Limiter.
- AVC-MVC Selector on Front Panel.
- Stable Oscillator and BFO for Clear AM CW and SSB Reception.
- Built-in Edgewise S-Meter.

Outstanding Bandspread, Selectivity with a built-in Q-multiplier, and sensitivity combine to make the HA-230 one of the "hottest" general coverage bandspread receivers LAFAYETTE have ever offered. A special filament transformer provides continuous voltage on critical oscillator and mixer stages to maintain frequency stability, prolong tube life, and give faster "warm up." Electrical bandspread calibrated on amateur bands 80 through 10 metres and an 0-100 logging scale make the HA-230 an ideal receiver for amateurs and SWL's.

Receiver Sensitivity—1.0 microvolts for 10 db Signal-to-Noise Ratio. The built-in BFO can be used to separate CW stations by means of the pitch control, while the Q-multiplier adds the selectivity needed for crowded phone band operation.

Front Panel Controls: FUNCTION SWITCH, AUDIO GAIN, SELECTIVITY (Q-Multiplier), FREQUENCY (BFO), BAND SELECTOR, IF GAIN, ANTENNA TRIMMER, AVC-MVC SWITCH, ANL SWITCH, MAIN TUNING, BANDSPREAD TUNING, HEADPHONE JACK.

Tubes: 3—6BA6, 2—6BE6, 2—6AV6, 1—6AQ5, 1—5Y3. For 220-240 VAC.

A limited number of HE-30 receivers is still in stock at $146.50 (£73/5/-)

Model HA-230 Receiver	$159.50 (£79/15/-)
Model HE-48 Matching Speaker 3" x 5"	$9.75 (£4/17/6)

SEND REMITTANCE WITH ORDER FOR IMMEDIATE DELIVERY ANYWHERE.

LAFAYETTE ELECTRONICS
Division of Electron Tube Distributors Pty. Ltd.

All Mail Inquiries and Orders to:

VICTORIAN SALES CENTRE
AND HEAD OFFICE,
15A WELLINGTON STREET
WINDSOR, S.1, VIC., 51-6362.

See the LAFAYETTE receivers and range of Test Equipment also at:
ELECTRON TUBE DISTRIBUTORS PTY. LTD., 523 Old South Head Rd., Rose Bay, N.S.W. Phone 37-6472.
TISCO AGENCIES, Overend and Hampton Streets, Woollongabba, Q'land.
MACK'S ELECTRONICS, 199 Rundle Street, Adelaide, S.A.
WINDSOR SERVICES, Smith Street, Darwin, N.T.

waggon the strain gauges chang their resistance and the bridge becomes unbalanced. The out-of-balance voltage forms the output o the load cell of the order of a few millivolts which varies linearly and directly with the load on the cell. The cell is capable of weighing u to 100,000lb and is insensitive t temperature changes.

(b) **The high-gain amplifier**

The output of the load cell i passed to a high-gain chopper amplifier which is of high accuracy, low ripple, and rapid response. The amplified output signal is then passed to a special filter amplifier which is a narrow band amplifier with a cut-off of about 2 cps. This serves to eliminate the effect of spurious vibrations on the weight signal due to waggon bounce, ground vibration, etc.

(c) **Analogue to digital converter**

The output from the filter amplifier is applied to an analogue to digital converter which is in the form of a precision multi-vibrato which generates pulses at a rate directly proportional to the magnitude of the input voltage.

(d) **Computing unit**

The output pulse train from the analogue to digital converter i counted over a predetermined time by the computing unit. The inpu pulses are applied to a gate which is opened by a signal from the control unit. The pulses are then counted by a cascade of decade counting units. At the end of the predetermined time interval, the gate i closed, and the total number o pulses counted is displayed visually and also provided for the printer.

(e) **Control unit**

The predetermined count time i governed by a crystal oscillator-controlled digital clock. The uni also includes a trigger circuit which sets the weighing cycle in motion when a waggon reaches the weighbridge and an alarm circuit which sounds an audible alarm and causes a special mark on the print-out i a waggon passes over the weighbridge at an excessive speed.

(f) **Printer**

The digital printer is a solid-state instrument designed to provide permanent printed record of th data received from the computin unit. The input data from the computing unit is in the form of parallel four-wire output in 8—4— —1 binary decimal code. The printe converts this into a four-figure decimal read-out.

Print-out can be arranged to tak place at a location remote from the weighbridge if this is required for con venient operation and the equipmen may be modified to provide punched card or punched-paper tape output i necessary.

The Railweight system was designe and developed in U.S.A. by Internationa Railroads Weighing Corporation, an the Industrial Automation Division o Hawker Siddeley Dynamics Ltd. wer responsible for the electronics aspect of the system.

PULSE SOUND COULD REDUCE TV BANDWIDTH

The width of the radio-frequency channel required for broadcasting a television signal of a given video bandwidth could be reduced if the conventional form of sound emission were replaced bv one in which the sound is transmitted by means of a signal incorporated within the video waveform. One such method, known as Pulse Sound, utilises pulses occurring during the line-blanking intervals, which are modulated by the sound signal.

By A. V. LORD and E. R. ROUT, B.B.C. Research Dept.

The pulse-sound system described es not, in practical terms, restrict the oice of video bandwidth, and such a tem could be used with any 625-line tem having a video bandwidth greater in 3MC. Thus, it is possible to con- er the RF channel requirements in ms of the television standard alone. r example, if it is considered essen- l that future 625-line transmissions in VHF band should use a colour sub- rier of 4.43MC, it would appear pos- le to accommodate, using pulse ind, a television signal conforming Standard G within an RF channel ndwidth of 6MC.

The total amount of information ich could, in theory, be accommo- ted within the line-blanking interval the 625-line standard is very large l a pulse-sound system could be de- ed which, if no other considerations re involved, would have a very high formance. However, in an attempt provide a system which may be in- rporated into current transmissions hout affecting the operation of sent-day receivers (i.e. a compatible tem), and in order to permit the use a relatively simple form of pulse- ind demodulator in the domestic re- ver, attention has been so far con- ed to the use of one pulse per blank- interval, the pulse being modulated position by the sound modulation. e audio-frequency bandwidth is in- ently restricted to half the line-scan quency (i.e. about 7.8KC).

This limitation of audio bandwidth, ilst apparent when using high-quality ind-reproducing equipment, is not isidered significant when the signal is roduced by the audio systems of ical domestic television receivers. If future receivers could be designed so that they were immune to a modulated pulse in the line-synchronising interval, a second pulse could ultimately be introduced and thus extend the available audio bandwidth to 15KC.

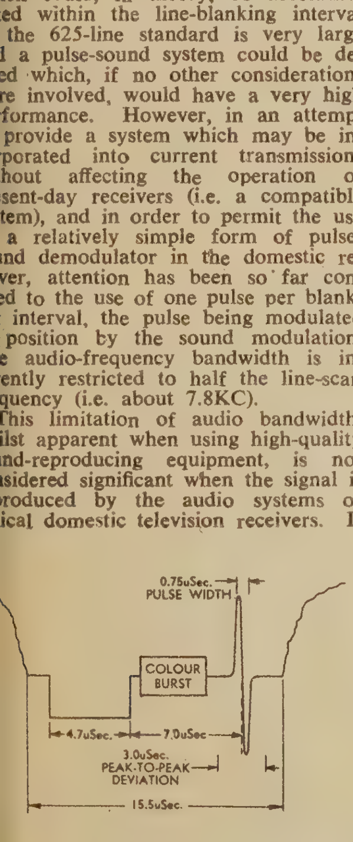


Figure 1. Pulse sound signal in line blanking interval.

A pulse-sound system may be regarded as compatible with present-day receivers if the modulated sound pulses do not disturb the picture (e.g. line synchronisation) and if the sound pulses themselves are not visible to viewers. The limited tests so far carried out show that both these criteria are satisfied by sound pulses of the form and position shown in figures 1 and 2.

Figure 1 shows the waveform of a 625-line, line-blanking interval together with the sound pulse. Figure 2 shows modifications to the field-synchronising waveform which are necessary in order to preserve continuity of the sound pulses; the modifications to the field-synchronising signal do not significantly affect the operation of current receivers. The pulses are position-modulated by the audio signal, and the maximum displacement is ±1.5usec. In order to accommodate this deviation the line-blanking interval has been increased in duration by approximately 3.5usec (or 7 per cent of the active-line duration).

The pulse-sound system is very resistant to co-channel interference and would not demand a change to the appropriate C.C.I.R. protection curves. On the other hand, an interfering signal incorporating pulse sound would provoke slightly greater interference than a standard vision signal.

With regard to multipath reception, when ghost images appear on the picture, subjective appraisals have shown that the impairment of pulse sound is likely to be substantially less than the associated picture impairment.

The intrinsic process performed in the pulse-sound receiver is to measure, once per line, the position of the sound pulse with regard to a regularly recurring position (e.g. the leading edge of the line-synchronising pulse). The output of a line-flywheel circuit may, in principle, be used as a reference and may be made sufficiently free from disturbances due to noise. However, line-flywheel circuits used in current domestic receivers are subject to disturbance by the field-synchronising signal and, although this disturbance is tolerable at the top of the picture, it is too severe to permit the flywheel-circuit output to be used for sound-signal demodulation. In receivers designed specifically for pulse sound it should be possible to provide, economically, a higher-performance line-flywheel circuit which is used both for scanning purposes and for providing a stable sound-demodulation reference. The form of synchronising signal shown in Figure 2 makes it possible to remove field information prior to the synchronising of the line-flywheel oscillator.

Other means of demodulation may be used. For example, the audio signal can be recovered from the phase-modulated sound pulses by applying them to an integrating circuit; in this method of demodulation no reference oscillator is required.

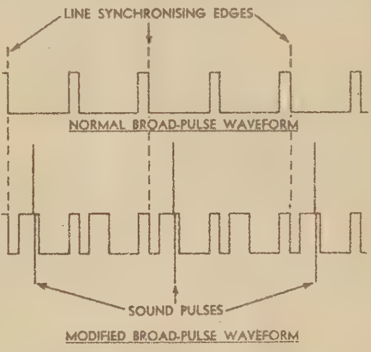


Figure 2. Line synchronising signal providing also a sound-modulation reference.

The main functions carried out in a pulse-sound receiver are summarised below:

(a) Extraction of the sound pulse from the video waveform:—In order to separate the sound pulse from other components of the video waveform it is desirable to use a gate which is opened once per line for an interval embracing the peak-to-peak deviation of the sound pulse. The sound pulse should also be subjected to limiting at this stage so as to prevent all noise other than that occurring on the high-slope region of the sound pulse from reaching the demodulator, thus minimising the effects of noise.

(b) Demodulation:—The audio modulation of the sound pulses must be recovered by one of the methods discussed earlier.

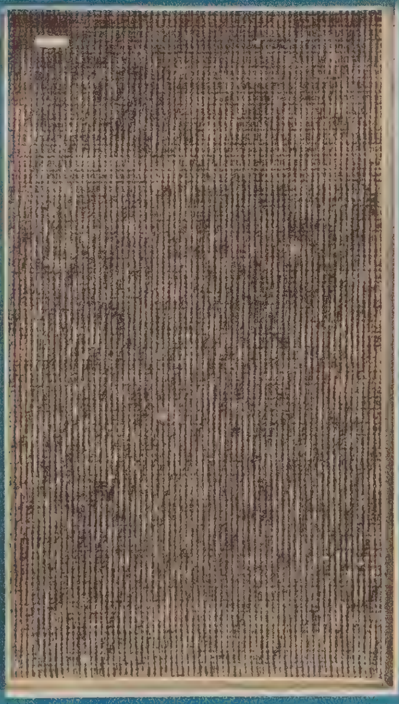
(c) Filtration:—The audio signal must be passed through a network which attenuates frequencies above 7.8KC so that spurious signals generated by the modulation process are not reproduced.

(d) Muting:—In order to prevent the possibility of loud and distressing sounds during receiver warm-up, channel-changing, etc., a simple circuit may be incorporated which will silence the receiver when the demodulator is supplied with abnormal signals. ▪

("Wireless World," February, 1966)

THE LEAK SANDWICH Mk. II...

THE ONLY COMPACT SPEAKER SYSTEM OFFERING SUBSTANTIALLY LINEAR FREQUENCY RESPONSE!



When H. J. Leak first introduced the revolutionary LEAK Sandwich Speaker System, it was described as a "totally new concept in sound reproduction". The unique piston action of the bass unit was the first major advance in sound reproducers since the invention of the moving coil system by Rice-Kellogg in 1925. Purity of sound, distortion-free reproduction and outstanding transient performance have established these unique systems in television and broadcasting studios throughout the world where they are used as quality monitors.

Although the overall frequency response of the LEAK Sandwich extends from less than 30 c/s to over 20,000 c/s, between 50 c/s and 15,000 c/s **the response is substantially linear,** varying only plus or minus 2 db.! No other similar sized speaker system can match this remarkable performance. With high quality signal input musical reproduction is completely free of coloration.

With the release of the new LEAK Sandwich Mk. II discriminating music lovers have the opportunity of adding the most effective and advanced speaker system ever available to their musical reproduction equipment. Measuring only 26" x 15" x 12" the Mk. II LEAK Sandwich offers a choice of magnificent Scandinavian walnut and teak timbers . . . and the removable front panel enables change of speaker fabric to match any furnishing decor.

TECHNICAL FEATURES OF THE NEW LEAK SANDWICH Mk. II.

☐ Advanced design heavy magnet treble unit ☐ Isolated compartment for treble unit to eliminate cross modulation ☐ Air-tight outer cabinet ☐ Interior cabinet surfaces coated with unique bituminous material to provide complete internal sound absorption ☐ Bonded acetate fibre with polyutherene lining assures excellent bass response and freedom from resonance ☐ The cone of the 13" bass speaker is 200 times as stiff as conventional speaker units ☐ Highly compliant surround permits long cone excursions ☐ Sound is reproduced free of break-up distortion.

Australian National Distributors :

Simon Gray Pty. Ltd

Head Office: 28 Elizabeth Street,
Melbourne, Vic. Tel. 63 8211, 63 8166

Sydney Office: 26 Ridge Street,
North Sydney, N.S.W. Tel. 92 3890.

INTERSTATE REPRESENTATIVES:

N.S.W.: Audio Engineers Pty. Ltd.,
342-344 Kent Street, Sydney. Tel. 29 673

S.A.: Eilco Sales Pty. Ltd., 9 Osmond Terrace,
Norwood, S.A. Tel. 3 6345

Q'land: Sydney G. Hughes, 154-158 Arthur St.,
New Farm, Brisbane. Tel. 58 1014

W.A.: Athol M. Hill, 613-615 Wellington Street,
Perth. Tel. 21 7861

Tas.: K. W. McCulloch Pty. Ltd.,
109 York Street, Launceston. Tel. 2 5322

A.C.T.: Australian Physical Laboratories,
P.O. Box 225, Canberra City.
Tel. 4 3010 (Mr. J. E. Howe)

N.T.: Pfitzner's Music House, Smith Street,
Darwin. Tel. 3801

SCIENTIFIC AND INDUSTRIAL NEWS

New high-vacuum technique

An ultra-high vacuum chamber system that produces vacuum vels approaching those of deep space has been supplied to the .S. Air Force Aero Propulsion Laboratory by Union Carbide orporation. This is the first commercial unit capable of attaining ultra-high vacuum levels by cryosorption pumping echniques.

In actual tests, chamber pressures in the 10 pico-Torr to he 1 pico-Torr range have been obtained. The integrated system onsists of a chamber complete with bake-out equipment, auging, instrument connections, and the cryogenic vacuum umping array which features liquid-nitrogen, gaseous and liquidelium refrigeration systems and a bonded molecular sieve cryoorption panel. Because no conventional type of ultra-high acuum pump is required, the cryopumped vacuum environment represents an ultimate in the state-of-the-art relative to leanliness standards.

The cryogenic vacuum pumping array located inside the hamber employs liquid nitrogen and gaseous helium-cooled ryopanels and a liquid helium-refrigerated cryosorption panel. he liquid nitrogen surfaces pump such high-boiling gases as ater vapour and carbon dioxide. The gaseous helium-cooled anels cryopump oxygen and nitrogen. The liquid helium-cooled ryosorption panel pumps the lowest boiling gases such as neon, ydrogen, and helium. The liquid nitrogen-refrigerated elements e physically arranged to intercept the major thermal loads, us minimising liquid helium consumption.

Initial rough pumping of the chamber's 15-cubic foot work pace is effected with a mechanical pump in combination with n ambient temperature molecular sieve absorbent trap to obtain acuums of about 1 milli-Torr. All further reduction in system ressure is achieved by the cryogenic array. The roughing sysm is also used to pump gas loads during unit bake-out, after hich the chamber is isolated by closing a valve. A cryosorpon roughing system can be considered as a possible alternative the mechanical pump on future units to provide a cometely hydrocarbon-free system.

Measured net pumping speeds of the array, available in e test volume, approximate 13,000 litres per second for hydron and 7900 litres per second for helium. By careful design, e rate at which liquid helium is evaporated from the pump servoir is only six to eight litres per day.

Accurate oxygen analysis

Servomex Controls Ltd., of Crowborough, Sussex, U.K., has signed a new industrial oxygen analyser, Type OA 137, which ilises magnetic susceptibility cells. The cells measure the force a body suspended in a non-uniform field and by using ectro-magnetic feedback, an accurate linear electrical output obtained. This method of measurement of magnetic susceptility is completely free from sensitivity to thermal conducity or to density of the sample gas and a highly specific termination of oxygen is obtained. The test body is extremely ht and is suspended on platinum ribbon, providing a very bust system which will stand up to industrial conditions.

In the type OA 137 analyser, a continuous null balance maintained by a photocell and amplifier system using solid ate devices of high reliability. The energising lamp is run half power and an operating life in excess of one year predicted.

The instrument has a built-in sample panel which controls the flow to the analyser and provides for adjustable by-pass. There are quick-release plug-in facilities for connecting samples or calibration gases and the equipment includes a filter and a liquid stop valve.

The instrument has five switched ranges covering 0-2.5 per cent to 0-100 per cent oxygen and the accuracy is plus or minus 1 per cent of span or plus or minus 0.05 per cent oxygen. The electrical output is 5, 10 or 100mV for full scale on each range, selected by an internal switch and it is also possible to obtain a current output up to 10mA maximum, which is useful for driving current to pressure transducers or digital transducers.

The makers say the Servomex OA 137 analyser is suitable for numerous chemical plant and refinery applications including end point determination or tail gas monitoring in oxidation reactions. It is said to be particularly suitable for measuring the oxygen content in furnace gases, especially in boiler flues where it makes possible a close control of the combustion efficiency by enabling the operator to maintain the correct fuel-to-air ratio. The fast response speed is an important feature in automatic control applications.

Colouring sheet steel

Any colour can be obtained on sheet steel by depositing a very thin layer of lead oxide on it in an electrolytic bath, according to a patent taken out by Yawata Iron and Steel Company, of No. 1, 1-chome, Marunouchi, Chiyoda-ku, Tokyo. Different colours are obtained by varying the thickness of lead oxide deposited on the surface of the steel.

Yawata claims that the coloured layer is corrosion-proof and that sheet so treated is ideal for use in the manufacture of toys, boxes, car components, radios and many other articles pressed out from sheet steel. The electrolyte used is a solution of lead nitrate in water. The thicknesses of the deposited layers are less than two microns.

Being lowered down the ventilation pipe of a double-bottomed tank on board the Union Castle liner Reina del Mar is this articulated TV camera, developed by Pye Laboratories, Cambridge, England. The entire length of the camera, with amplifier and lighting system, is only 28in, and its diameter is 2 1/8in. It has been specially designed for small bore pipe inspection in oil refineries, chemical plants, power stations, gasworks and ships. The camera is articulated to allow it to pass easily round bends in pipes.

reliable
pre-tested
tight performance

NEWMARKET

PACKAGED CIRCUIT AMPLIFIERS

The Newmarket PC range provides *Development Engineers* with reliable pre-tested units of tight performance specifications to incorporate in any equipment at minimum cost. Use of such units not only obviates the need to develop purpose-made amplifiers for every job, but cuts down the number of small components that company *Buyers* have to buy and maintain in stock.

Each unit is guaranteed for 12 months and replacement units are supplied if any fault develops. Our guarantee also enables the manufacturer to guarantee his product to the ultimate user.

some applications

MODEL No. PC 1
Stethoscope Amplifier.
General Purpose Audio Amplifiers and Drivers.
Intercomm Amplifier.
Telephone Amplifiers.
Laboratory Instrument Amplifiers.
Back Projector Audio Amplifiers.
Loudspeaker Amplifier.
Hospital Board Control Units Intercomm Amplifiers.

MODEL No. PC 2
Modulator Driver Stage.
Intercomm.
Church Hearing Aid Amplifier.
Office Dictating Machines.
Door-Caller Monitor Amplifier.
Inter-Office Communication Amplifier.
Tape Replay Amplifier.
General Purpose Audio Amplifiers and Drivers.
Telemetry Audio Amplifier.
Radio Receiver Audio Amplifier.
Telephone Amplifiers.
Educational Equipment Audio Amplifiers.
Laboratory Instrument Amplifiers.
Language Laboratory Amplifiers.
Tape Recording Amplifiers.
TV Aerial Riggers Intercomm Amplifier.
Loudspeaker Amplifier.
Radio Concentrator.
Mine Communication Amplifier.

MODEL No. PC 3
Disc Talking Book.
DC Relay Driver.
Telecommunications Conference Monitor Amplifier.
Sound-level Meter Amplifier.
Close Background Music Amplifier.
Sound Reinforcement Amplifier.
General Purpose Audio Amplifiers and Drivers.
Low Power Battery Stereo.
VHF Communications Receiver Audio Amplifier.
Radio Receiver Audio Amplifier.
Telephone Amplifiers.
Heating and Ventilating Control Amplifier.
Laboratory Instrument Amplifiers.
Museum Portable Commentary Equipment System.
Radio Relay System Amplifier.
Loudspeaker Amplifier.

MODEL No. PC 4
Battery Record Player.
General Purpose Amplifiers and Drivers.
Office Dictating Machines.
Telephone Amplifiers.
Pay TV Control Circuits Amplifier.
Stereo Listening Booth Amplifiers.
Laboratory Instruments Amplifiers.
Loudspeaker Amplifier.
Radio Relay System Amplifier.

MODEL No. PC 5 Plus
Salesman's Portable Cine Projector Audio Amp.
Meter Type Galvanometer Amplifier.
Helmet Intercomms: (a) Diving Suits,
(b) Crash Helmets, (c) Pilot's Helmets.
Car Radio Audio Amplifier.
Communications Receiver Audio Amplifier.
Lecturer Non-interruption Monitor.
Erotogenic Amplifier.
Small public Address Portable Amplifier.
Servo Amplifier (Hydraulic valve control).
General Purpose Amplifier.
Fault Finding Tone Detector Amplifier.
Tape Replay Amplifier (Aircraft Ground equipment).
Automation Drive Amplifiers,
Colour Television Receiver Audio Amplifier.
Tape Recorder Replay Amplifier.
Hi-Fi Amplifier.
Vibration Test Amplifiers.
Telephone Intercomm System.
Office Dictating Machines.
Telephone Amplifiers.
Fire Detection Equipment Amplifier.
Mines Telephones Amplifiers.
Cigarette Manufacturer Production Test. Equipme
Amplifier.
Instrument Audio Amplifier.
Sound Reinforcement Intercomm Amplifier.
Null Detector Instrument Amplifier.
Public Address Amplifier.
Mobile and Fixed Transmitter Modulators.
Telephone System Audio Amplifier.
High Power P.A. Driver Amplifier.
TV Camera Channel Talk Back Amplifier.
Sound Intercomm Amplifier.
Industrial Test Instrument Amplifier.
Burglar Alarm Audio Amplifiers.
Transceiver Audio Amplifiers.
Laboratory Instrument Amplifiers.
Airport Loudspeaking System Amplifier.
Pocket Paging System Amplifier.
Carrier System Mains Intercomm (Portaphone).
Loudspeaker Amplifiers.
Electronic Organ Power Amplifier.

MODEL No. PC 7 Plus
Tape Language Laboratory.
Telephone Dictating Machine Amplifier.
Automation Drive Amplifiers.
Control Amplifier for Textile Machinery.
Radio Receiver Audio Amplifier.
TV Receiver Audio Amp.
General Purpose Amplifier.
Telephone Amplifier.
Laboratory Instrument Amplifiers.
Tape Language Laboratory Amplifier.
Loudspeaker Amplifier.

specification details

A typical miniature Audio-Amplifier is illustrated actual size overleaf. Circuits are of transformerless, complementary symmetry type, operating off Standard Voltages. Can be wire-in or plug-in as required.

PERFORMANCE DATA	PC1	PC2	PC3	PC4	PC5	PC7	PC9
Power Output mW	150	400	400	400	3W	800	Pre-a
Input Sensitivity mV	50	1	5	150	5	5	1V
Input Impedance ohms	1.5K	1K	2.5K	220K	1.5K	1.5K	1M
Output Impedance ohms	40	15	15	15	3	8	600
Supply Voltage-volts	9	9	9	9	12	9	9
Typical distortion %	2	3	3	3	3	3	1
Frequency response	300-15K	200-12K	200-12K	200-12K	50-12K	50-12K	20-2
Overall Dimensions All ¾ in. high	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾	2 x

tecnico ELECTRONICS PTY. LTD.
53 Carrington Road, Marrickville, N.S.W.

SYDNEY: General Accessories Limited,
443 Concord Road, Rhodes.

MELBOURNE: Radio Parts Pty. Ltd.,
562 Spencer Street, Warburton Franki Limited,
220 Park Street.

BRISBANE: General Accessories Pty. Ltd.,
50 Little Edward Street.

ADELAIDE: General Accessories Pty. Ltd.,
81 Flinders Street.

PERTH: General Accessories Pty. Ltd.,
46 Milligan Street.

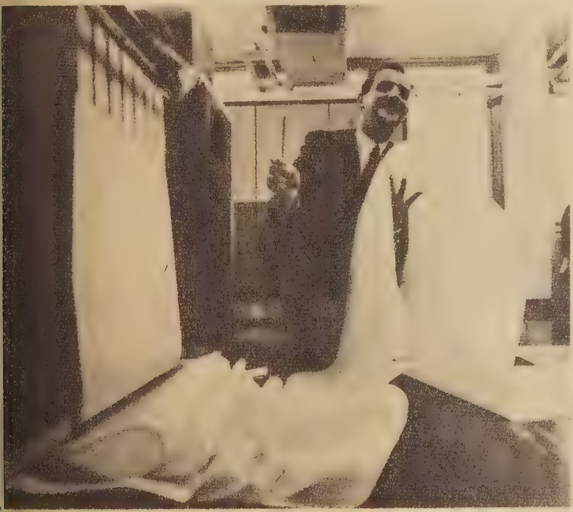
Holes in the ground

A quick way of making vertical cylindrical holes in the ound for posts, masts or pipes, has been patented by Anstalt ır Montage-Technik, of Vaduz, Liechtenstein.

The equipment has a vertically mounted barrel which fires a t expendable projectile into the ground. The markers claim that lique "shots" are impossible, that the depth of the hole required easily controlled by varying the explosive charge and that costs e substantially less then those of conventional methods.

Helps blind to read

A device which enables blind people to read ordinary print s been patented by Bengt Anders Benson, Styckjunkargatan 5, ɔckholm, Sweden. A photographic image of a word is transtted to a plastic disc which is studded with steel needles. ı electric current passing through the needles causes a prickg sensation to be passed to the fingers when a hand is passed er the disc. In this way the letters of a word can be "felt" d reading can be achieved if the words are passed slowly er the disc by the transmitting mechanism.



The mess of paper littering the floor in this picture is issuing from the innards of the British Meteorological Office's new computer, Mr Comet. Built at a cost of £S500,000 ($1.25m), Mr Comet is said to be able to cope with one million calculations a second. The computer deals with weather reports pouring in to the M.O. premises at Bracknell, Berkshire, from 1,200 land stations, 300 ships and 600 radio balloons around the world. From this information it produces weather charts.

Right:
Now under development in a Los Angeles hospital is a computer-controlled life-sized model for training medical students in anesthesiology. The picture is an artist's impression of the model in use under simulated operation theatre conditions. Should the student make a mistake in administering the anesthetics, the model reacts in a life-like manner, to simulate the effects the mistake would have on a real patient.

lid state TV link

The first completely solid-state UHF transmitter for beaming vision programs is currently operating under the supervision the Australian Post Office for transmissions from Sydney Madden's Plains, near Wollongong, N.S.W. The equipment was plied by S.T.C., who say that all other radio link equipment use throughout the world for transmitting television signals at least one valve. The Sydney end of the link is located he P.M.G. building at Redfern. The equipment is designed to rate at a carrier frequency of 2,000MC.

Electric glue gun

Glue which must be heated to become liquid can be applied easily with an electrically heated gun offered by the United Shoe Machinery Corporation of 140 Federal Street, Boston, Massachusetts. The gun, weighing ¾lb, is loaded with polyethylene thermoplastic glue. In four minutes, the glue is melted and can be forced out of the nozzle by a handle.

Glueing machinery to the floor

Heavy machinery, such as lathes, millers, circular saws and other machine tools, is now being glued to the floor, instead of bolted, in some British factories, as the result of a development of Carlton, Brown and Partners, of Tamworth, Birmingham, England. The company has developed a material called "Adhesium," supplied in the form of rolls of adhesive impregnated felt. The base of the machine to be fixed is placed on strips of the felt, and in less than 12 hours the glue is set.

A report in the B.B.C. "Science in Industry" program says the pads cut out all the work of chipping holes in concrete for the massive fixing bolts which would otherwise be used.

All-plastic walls

Dividing walls made completely of plastic materials have been patented by Sicedison S.p.A., Via Principe Eugenio 5, Milan. The lightweight walls are intended particularly for houses, offices and exhibition stands. Slotted uprights are fitted to floor and ceiling and panels alternating with horizontal bars are slotted into the uprights — rather like a child's building set.

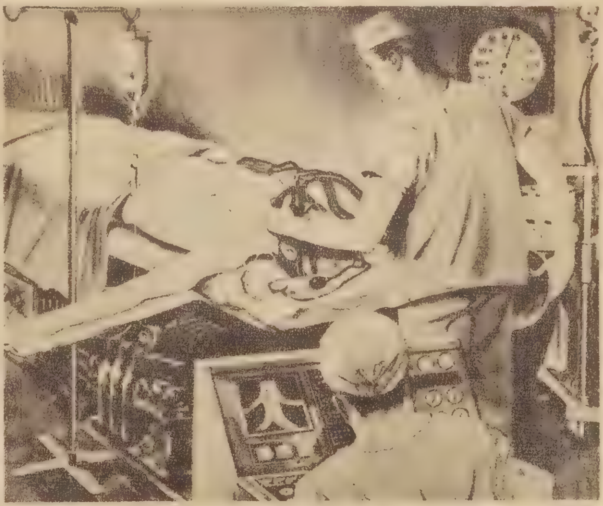
New range of integrated circuits

A new range of integrated circuits has been introduced by Ferranti Ltd., Gem Hill, Oldham, Lancashire, U.K. The new circuits, called Micronor II, are monolithic DTL (Diode Transistor Logic) circuits, said to offer very high noise immunity, ultra high switching speed, large fan-out and wide application. They are available in 8-lead TO-5 and standard 14-lead pack encapsulations, and typical circuits contain up to 60 discrete components.

Micronor II is already system proved, and a new production line will soon be in operation capable of producing 40,000 circuits a week. Since commencing work on integrated circuits in 1960, Ferranti has introduced over 100 different integrated circuit designs, in its Micronor I and Microlin ranges.

"Paper" from ceramic fibres

Ceramic fibres matted into "paper" form a high temperature material for filters or gaskets, claims Babcock and Wilcox Company, of 161 E. 42nd Street, New York 17. The material can be used at temperatures up to 2 ,300 degrees F., the company says, and can be rolled into tubes, cut for use as refractory linings or die-cut for gasket use. Density is about 12lb per cubic foot.



Anti-fouling paint

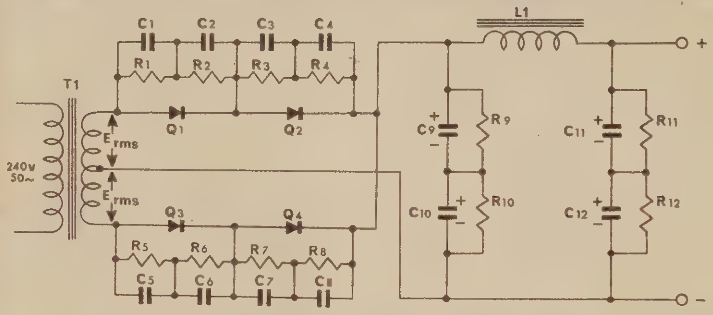
A general purpose anti-fouling paint, claimed to be cheaper to make than those in present use, which will last for long periods and will not damage the treated surface in any way has been developed by Kansai Paint Company, 365 Kanzai, Amagaski-shi, Hyogo-ken, Japan. The paint is non-toxic and non-irritative and said to be particularly effective on ships and harbour installations in polluted waters.

SOLID STATE RECTIFIERS

•Inexpensive •Long Life •Efficient •Small Size •Low Heat •No Filaments

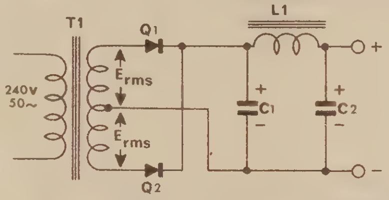
Typical Circuit Examples:

500 VOLTS 200 MA FOR TRANSMITTERS, AMPLIFIERS OR MODULATORS



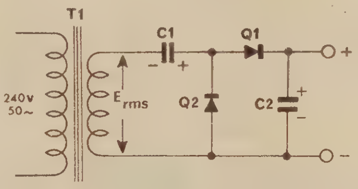
C1-C8	.0022 ufd 600 V.W.
C9-C12	64 ufd 350 V.W.
R1-R8	270K ohm ½ Watt Carbon
R9-R12	25K ohm 5 Watt Wire Wound
L1	5 Henry Choke (Ferguson CF113, A & R 3047, Trimax TZ467)
T1	350-0-350 V at 200 MA A & R PT1938 VO=490 V.DC 180 MA 385-0-385 V at 250 MA Ferguson PF171 VO=500 V.DC 230 MA 400-0-400 V at 250 MA Trimax TP4327 VO=520 V.DC 230 MA
Q1-Q4	Anodeon IN3196 800 PIV Rectifiers

300 VOLTS 150 MA FOR RECEIVERS OR SMALL AMPLIFIERS

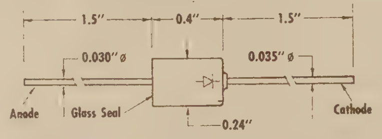


C1-C2	64 ufd 525 V.W.
L1	12 Henry 150 MA (Ferguson CF108, A & R 3042, Trimax TZ465
T1	250-0-250 V at 150 MA (Ferguson PF1508, A & R PT1896)
Q1-Q2	Anodeon 1N3196 800 PIV Rectifiers

45 VOLTS 45 MA FOR BIAS SUPPLIES



C1	100 ufd 50 V.W.
C2	100 ufd 100 V.W.
T1	18.9 V RMS Three 6.3 V Heater Windings in series
Q1-Q2	Anodeon AD100 100 PIV Rectifiers



This range of Rectifiers is manufactured in Australia especially for Radio, TV or industrial equipment applications. Your nearest Anodeon Sales Office will be glad to give you more information. Just drop us a line or give us a call any time.

ANODEON type			AD100	1N3193 1N3253	1N3194 1N3254	1N3195 1N3255	1N3196 1N3256	AD1000
Type of Load			CAP	CAP	CAP	CAP	CAP	CAP
Maximum Peak Inverse Voltage		V	100	200	400	600	800	1000
Maximum RMS supply voltage		V	35*	70*	140*	210*	280*	350*
D.F. Forward current	at 25°C	MA	500*	500*	500*	500*	500*	500*
	at 75°C	MA	500*	500*	500*	500*	500*	500*
Recurrent surge current		A	6	6	6	6	6	6
One cycle surge current (50 cps)		A	35	35	35	35	35	35
Max. Forward voltage drop at 500 mA		V	1	1	1	1	1	1
Max. rev. current at rated PIV and 25°C		UA	5	5	5	5	5	5
Max. average full cycle rev. current at Max PIV and 750 MA If at 75°C		UA	200	200	200	200	200	200

* For Resistive Loads Double Max. RMS Supply Voltage and Increase Forward Current to 750 MA

ANODEON
Sales Division:

N.S.W.: 443 Concord Road, Rhodes 73 0211
VIC.: 153 Sturt Street, South Melbourne 69 0300

GENERAL ACESSORIES: Stores Throughout Australia are also Holding Stocks

Automated TV station

The new MTN-9 television station at Griffith, N.S.W., which began operating December 15 last, is the first country TV station in Australia equipped with "memory" store, enabling automated program switching to take place during station break periods. The equipment consists of a combined vision and sound switcher which incorporates an eight-event memory store. With this, an operator can feed in program continuity information for the automatic machine control of projectors, slides, tapes and other presentation functions up to eight events ahead of actual requirement. Once programmed, only a button has to be pressed to set the complete "station-break" sequence automatically in train. The "memory" equipment was supplied by Amalgamated Wireless (Australia) Ltd., who also supplied the station's 10kW transmitter.

Security cards for locks

Cards carrying a magnetic pattern that he manufacturers claim cannot be duplicaed will allow the user to open a lock on nsertion, the pattern being read by an appropriate circuit in the lock. Called the "Securiti" system, it is designed to provide he answer to many types of security probems and can be adapted to various requirements.

Operating with the card system and claimed to be capable of so many variants that he system cannot be circumvented is a push-button panel carrying 12 buttons which have o be pressed in the right sequence after he card holder has inserted his card before he lock will yield. Any error in the sequence or tampering with the lock will set off an alarm. More information is available rom Roneo-Neopost, Lion House, Richmond, Surrey, England.

Vapour resistance measured

An interesting and simple unit to test packaging sheet for its resistance to water apour has been developed by Instrumenten n Apparatenfabriek Becker Delft N.V., of Delft, Holland. It is based on the amount f time needed to produce a predetermined olume of hydrogen by the reaction of water vapour with calcium hydride, the water vapour being drawn through a sample f the sheet.

The method gives results very rapidly nd can be used over a range of relative umidities. Accuracy is high and the equipment should appeal to manufacturers as rapid quality control system and to ackers as a check on goods inward.

Mobile lighting tower

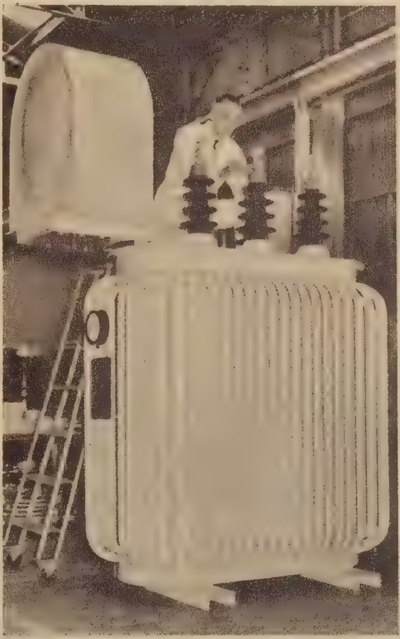
A mobile telescopic lighting tower, said o be capable of lighting an area of about acres, is offered by Audax, of Central venue, West Molesey, Surrey, England. he 60-foot high tower is particularly suitble for use on building and civil engieering sites, port installations, oil refineries nd airports and, when not in use as a ghting unit, as a radar or radio aerial.

Erection of the tower takes under half n hour, the makers say. It is mounted on four-wheel trailer which also carries four 000 Watt lanterns and a 6KW diesel enerating set. The whole assembly can be orry-mounted if desired.

Laser beam sees movement

Small linear displacements may be easured with the utmost accuracy and nsitivity by means of a laser light source ombined with a digital counting system. he laser's narrow beam of pure light is lit into two components by an interrometer beam splitter. One component mains unchanged, but the path length of the second is altered by a mirror driven by the device whose linear measurement is to be measured.

The reflected beams are recombined at the interferometer and produce an interference pattern of alternating dark and light fringes. The pattern corresponds to the magnitude and direction of displacement.



Shown here nearing completion in the Ducon Condenser factory at Villawood, N.S.W., is a series reactor. These are being increasingly used by power supply authorities, with high voltage capacitor banks for waveform improvement, and for limiting the severity of inrush currents or switching surges. Ducon produces these series reactors with ratings up to 66KV.

A photocell system scans these fringes. It produces an electrical output corresponding to the magnitude of the displacement. There are four of them wired in pairs to detect the direction of travel.

Massachusetts Institute of Technology developed the device for the Manned Spacecraft Centre whose Technology Utilisation Officer will supply further details from P.O. Box 1537, Houston, Texas 77001, U.S.A., under the reference B65-10161, NASA, Code AGP, Washington, D.C. 20546, and has powers to grant royalty-free rights for commercial use.

Nuclear information

A computer, which should eventually become the backbone of a general information centre on nuclear energy, has been installed at the International Atomic Energy Agency (IAEA) in Vienna, Austria.

IAEA is developing a General Information Processing System (GIPSY) for all informative and documentary material produced or received by the Agency. It includes a self-generating key-word system for classification according to subject matter and a program for the retrieval of information and documents using these keywords.

For over two years, IAEA has been active in the field of information storage and retrieval, and has used the IBM Service Centre in Vienna for a number of projects. Thus the comprehensive documentation for the third United Nations International Conference on the Peaceful Uses of Atomic Energy (Geneva, September 1964) was computer handled by the Agency. It was the first time that the list of papers and authors and subject indices were prepared by computer for an international scientific conference of that size.

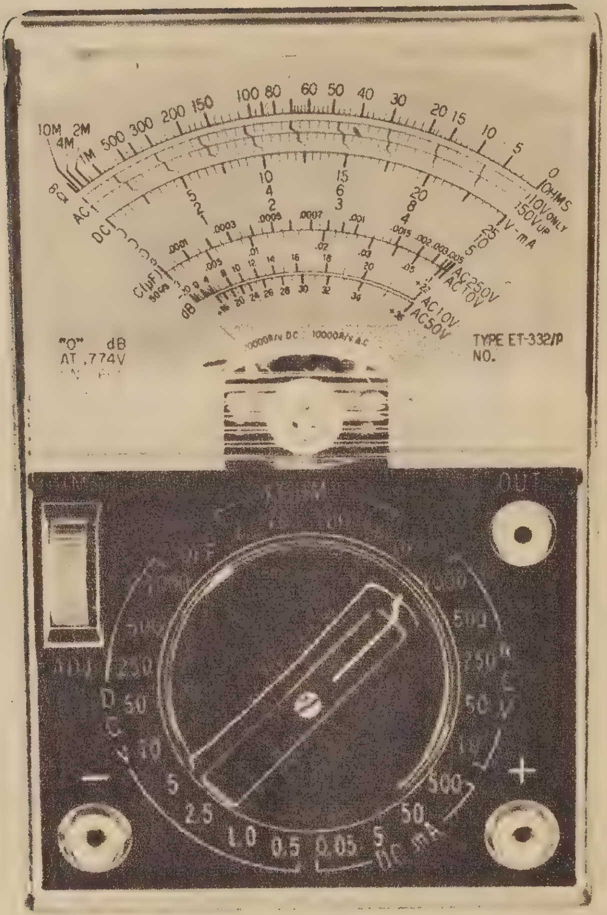
Several of IAEA's periodical publications such as its list of Library Holdings and Film Catalogue, have been produced in the past and will be automatically up-dated in the future with the help of the computer. So will the List of References in Nuclear Energy and similar material and various bibliographies.

Finding the fish

The Marconi International Marine Company says it now has a much-improved version of its Fishgraph fish-locating echometer installation. Known as the Fishgraph 2, the installation embodies circuit modifications and a new type of projector and housing which together are said to make much greater use of the power employed. Increased pulse lengths are said to provide

Britain's first wide steel strip line for colour coated steel is now in production at Richard Thomas and Baldwin's, in Wales. Built after five years' research at a cost of £S600,000 ($1.45m) the machine supplies strip steel up to 52in wide already colour coated for use in the building and manufacturing industries. Different coating systems are used, according to the purpose of the finished product.

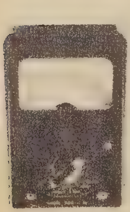
this is only one from



ET-322/P
$14.00

the wide range of . . .

PEAK MULTIMETERS



400-J/P
$29.75

CT-500/P
$17.00

370-J/P
$22.00

380-N/P
$35.50

CT-620
$15.75

370-W/P
$46.00

CT-500
$15.75

200-H
$11.95

Peak multimeters, introduced to you over three years ago, have gained wide acceptance, with the electrician, industrialist, radio/T.V. serviceman and the laboratory technician until they are amongst the largest selling multimeter in Australia.

All instruments are guaranteed for 3 months against faulty materials or workmanship, provided such defective instruments are returned to us at customer's cost for the necessary attention.

All multimeters which we offer in 'Peak' brand have bee selected by careful laborator tests.

AVAILABLE FROM ALL
LEADING ELECTRICAL
RETAILERS
SOLE AUSTRALIAN
AGENTS

H. ROW
& CO. PTY. LT

substantial increase in the effective power the transmitted pulse.

To cater for variables in depths or eather conditions a control is fitted to e recorder unit; this enables the skipper vary the pulse length, within limits, to tain the best results. This facility, says arconi, gives the equipment greatly ineased ability, first to find fish, using the eatest pulse length, and then to obtain aximum discrimination by adjusting the lse length to the optimum for the type fish being sought.

iniature Radiophone

A new miniature radiotelephone set deed to operate in the 450-470MC band s been developed in U.K. by Pye Telemmunications Ltd., Newmarket Rd, Camidge. The company claims that h-quality two-way communication is ached over distances from two to five miles, th remarkable penetration of narrow eets and inside high buildings. The new diotelephone, called the Pye Pocketfone, s separate transmitter and receiver units, th measuring approximately 6 x 2 x 1 ches. Each unit has its own power supply, that connecting wires are unnecessary. e receiver has a concealed internal aerial, ile the transmitter has a rod aerial about inches long which springs out when the nsmit button is pressed.

Pye says the Pocketfone has remarkable ttery life, due to a new and patented baty economy circuit. The company visages that the equipment will be used police and fire services, but that it will also be suitable for a great variety of industrial and commercial applications.

SORTIE
OUTPUT
MICROVOLTMETRE
DECIBELMETRE
EVM 4 N° 2795-30
L.E.A
RUEIL (S&O)
ENTREE
INPUT

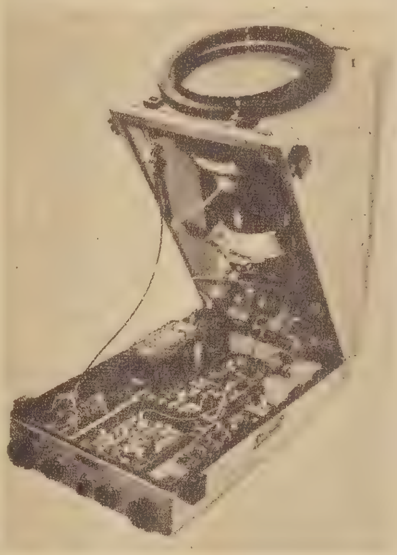
Illustrated is a new microvoltmeter, Type E.V.M.4, developed by Laboratorie Electro-Acoustique, 5 Rue Jules Parent, Rueil S. and O.) France. It has a frequency range of 25cps to 100KC, range 10 microvolts to 100 volts and decibel scale over —100 to +42dB. The makers say the instrument is stable and accurate hrough time, and is useable as a pre-amplifier.

Cable de-icers

As a result of extensive research and field testing, an ingenious solution to the problem of the icing of overhead power cables has been found. The work has come from research departments of the Central Electricity Generating Board and Edgar Allen and Co., P.O. Box 93, Imperial Steel Works, Sheffield, England.

Icing is a problem in that it causes sagging, and subsequent contact with other conductors, and when masses of ice suddenly drop off during a thaw there is rapid and dangerous bouncing of the conductors. The solution found is to have special sleeves on parts of the cable, each sleeve having, next to the cable but insulated from it, a magnetic alloy of low Curie point. That is to say, below this temperature the material is magnetic and above it it is not. An aluminium sleeve goes round the outside. At low temperatures the cable current induces a heating current in the aluminium and thus prevents icing. At higher temperatures there is no induced current. Thus an automatic heating device is achieved.

The alloy consists of 35 per cent nickel, 10 per cent chromium, one per cent silicon and the rest iron. Heat treatments are used to vary the properties. Tests have been done in the Lecht Pass in Northern Scotland. The company has covered the device by patents at home and abroad and is prepared to consider commercial applications.



This new Kelvin and Hughes small craft radar is fully transistorised and uses printed circuit techniques. Called Marine Radar Type 17, it is said to be particularly suitable for small craft with limited space and power supplies, and as a second radar on larger vessels. It has eight scale ranges from ¼-mile to 24 miles. A high-definition display is presented on a 9in tube. The scanner is basically a 6ft slotted waveguide unit with 1.2 degrees horizontal beamwidth, which, operating with a short pulse magnetron, results in high resolution and a high definition picture on short range.

2 New Transistor Projects

for fledgling electronic enthusiasts

These kits are designed to try your wings on. . . yet use professional techniques. With Kit No. 1 you use tag-tstrip mounting, then when you progress to Kit No. 2 you use the latest in transistor sub-miniature mounting—copper-backed matrix board.

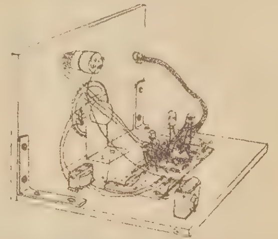
Both kits include a step-by-step instruction manual, fully illustrated and written in such a way that you can't go wrong. Detailed theory is also included so that you can easily understand how your kit works.

Kit No. 1 is a one transistor reaction radio receiver (the transistor is used twice—as a detector and an amplifier) and all parts and tools are supplied—**you don't need another thing after you open the box.**

Kit No. 2 is a three transistor audio amplifier that gives greater loudspeaker volume than you can use when combined with Kit No. 1. You can also use it for—loudspeaker volume for a crystal set . . . home address system . . . record player amplifier . . . voice control switch . : . completing stereo system . . . tape recorder monitor . . . inter-com . . . signal tracer.

Both kits only cost $13.95 (£6/19/6) each and they teach you professional construction techniques right from the beginning. You really learn what electronics is all about with these kits and their comprehensive instruction manual.

The transistors . . . batteries . . . capacitors . . . resistors . . . potentiometers with switches . . . loudspeaker . . . earpiece or microphone . . . tag strips . . . circuit boards . . . sundry hardware you receive can be used again and again in construction projects described in **Transistor Kits new monthly magazine for beginners** free copy with your kit. In this way you ensure that you learn electronics for the least possible expense.



You will be proud to switch on for your family and friends and explain how your radio and/or amplifier works. You will also be satisfied to know you have learnt the latest construction techniques.

Start today, clip the coupon below or write now to:

TRANSISTOR KITS
69A CHURCH STREET,
BRIGHTON, S5, VICTORIA.
PHONE 92-3159

Please send by return (Mark X).

( ) Details of the Transistor Kit Club (FREE).

( ) Kit No. 1 complete with Manual, tools, radio parts, hardware and sundries. Only $13.95 (£6/19/6) for everything you need.

( ) Transistor Amplifier Kit No. 2 complete with Manual, tools, electronic parts including extra transistors, hardware and sundries. Only $13.95 (£6/19/6) for everything you need.

( ) Special Combination Kit comprises kits 1 and 2 for only $25.85 (£12/18/6). You save 20/6.

Cheque/Money Order for £$ .... enclosed. (Complete refund if not satisfied, all kits guaranteed.)

NAME ....

ADDRESS ....

....

The PLAYMASTER 113 Stereo Power Amplifier

A high-quality fully transistorised stereo power amplifier, very suitable for use with our new Playmaster 112 Control Unit and the highly popular "Bookshelf" speaker enclosures. It offers high performance at a moderate cost.

By Jamieson Rowe

While the silicon transistor Playmaster 112 Control Unit described last December will connect to any of our valve-type power amplifiers to form a system capable of outstanding reproduction, the obvious "next step" is the development of matching transistor power amplifiers. This is so not simply because transistorisation is the "modern" thing, but because "solid state" circuitry now offers definite advantages in terms of improved reliability, higher electrical efficiency and reduced bulk.

Unfortunately, whereas the recent release of low-cost, high-performance silicon transistors has made it possible to design a Control Unit whose performance in many ways exceeds the established standards of valve circuit performance, and at a quite comparable cost, the same happy situation does not yet exist with power amplifier design.

It is, admittedly, not impossible to design a transistor amplifier whose performance equals or even exceeds that of the best valve designs. Although by no means an easy task, it can be done, as witnessed by the many excellent designs which have appeared in overseas journals and in local product applications literature. Nor is it a particularly difficult matter to produce some sort of an amplifier whose cost is equal to or even lower than that of many valve designs.

Where the real difficulty lies is in satisfying both these important engineering design criteria at once: To produce a high-performance amplifier whose cost is no higher than that of a comparable valve amplifier.

The amplifier described in this article is the end result of considerable effort on our part in tackling this problem. We must confess to being rather proud of it; it seems to us to strike a most realistic and attractive balance between performance and cost. While certainly not the "ultimate" in terms of performance, a glance at the specification panel will show that scant apology is required for its limitations.

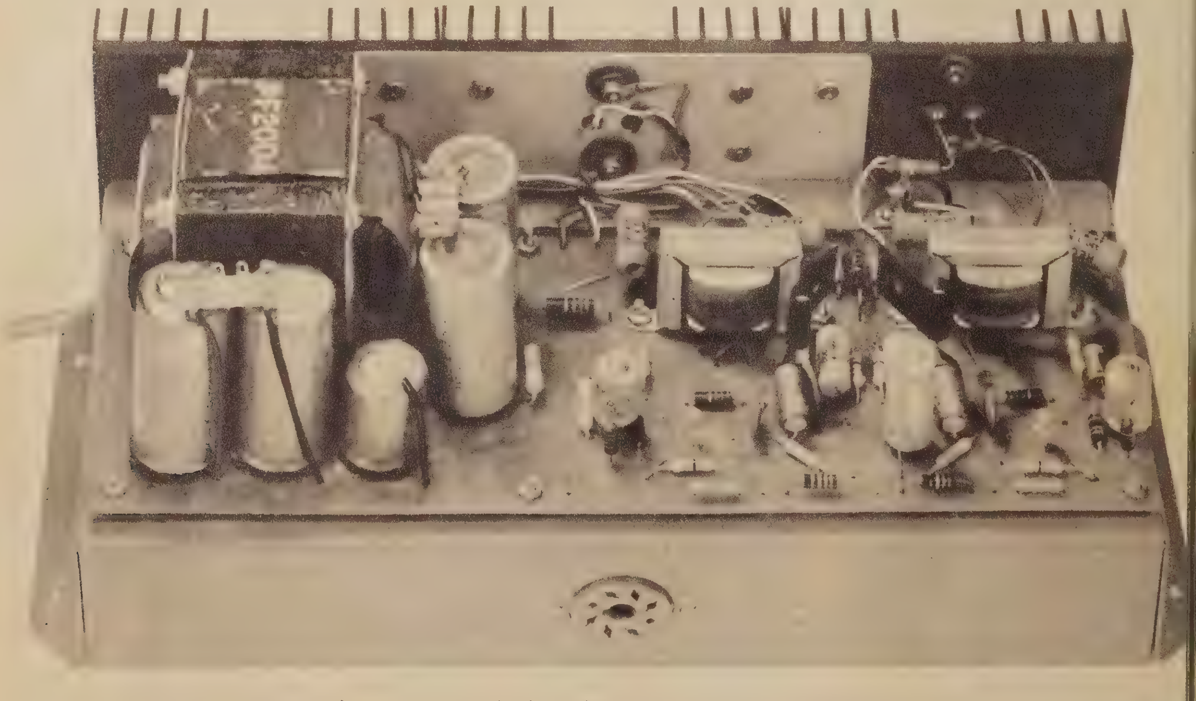
When used with the Playmaster 112 Control Unit and a pair of "Bookshelf" or similar high-performance speaker enclosures it gives a standard of moderate power reproduction which is in every way worthy of the label "high fidelity.

And yet, by deliberatelv restrainin the urge to produce a unit with "way out" specifications, we have been abl to keep the cost of the unit to a ver moderate figure indeed: We estimate tha a full kit of parts should cost aroun $60.00 (£30).

It should be noted that this is the average cost of a kit of parts for our mos recent Playmaster valve power amplifie the economy "101" design of Augus 1962. As the performance of the ne unit is in most respects quite comparabl with the 101, this testifies to our succes in arriving at a satisfactory performance cost compromise.

In short, the 113 may be regarded as virtually the transistor equivalent of the 101 in terms of both performance and price. It should thus prove the ideal choice for a great number of audio enthusiasts.

Electrically, the new amplifier desig has been evolved from the power ampl fier section of our first fully transisto ised Playmaster stereo amplifier, th "Unit Playmaster 105" of May, 196

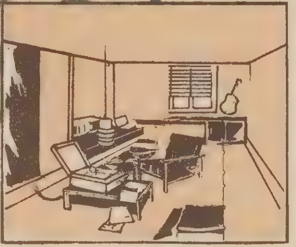


A top view of the Playmaster power amplifier.

SAVE $100's with these 3 great new *DO IT YOURSELF* volumes

PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA
PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA
PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA

Step by Step to a BETTER HOME



- ★ **EASY STEP-BY-STEP STAGES**
- ★ **ALL THE LATEST IDEAS**
- ★ **700,000 WORDS IN 1,600 PAGES**
- ★ **2,500 A-Z SUBJECTS BY 15 AUTHORITIES**
- ★ **1,000's OF ILLUSTRATIONS** ★ **EXPLANATORY FULL COLOUR SECTION**

Newnes New PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA counteracts the ever-rising cost of repair, maintenance and improvement to your home. It gives you expert, up-to-date guidance in simple language, shows you how to make fitments and built-in furniture, make home extensions. All latest innovations are given: double glazing, central heating, draught-free porches, room dividers. Everything you want for a better home, inside or out. Includes handicrafts for winter months, to save you hundreds of pounds in bills and make your home worth more in hard cash! See this new home handyman today . . . send for Free Examination and use it right away!

3 TIMES VALUE of any other Do-It-Yourself. More Details, More Subjects, it's COMPLETE.

EXAMINE THE 3 BIG BOOKS AT HOME *FREE* FOR 10 DAYS.

Fill in Coupon NOW! No one will call

FREE!

—to every purchaser ABSOLUTELY FREE a Tool Every Home Needs—MULTI - GRIP All - Purpose WRENCH. Beautifully machined, long for easy leverage, tough tool steel for enduring strength. Adjusts for small or out-size nuts; grips and shifts stubborn pipes, shafts, etc., etc.

OFFICE USE ______

Please send me Newnes PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA without obligation to purchase. I will either return the work within 10 days or I will send the first payment of £1.10.0 11 days after delivery, then 11 monthly subscriptions of £1 until the sum of £12.10.0 has been paid. The cash price within 10 days is £11.15.0. The offer does not apply to overseas purchasers, who should send the cash price of £11.15.0

Mr./Mrs./Miss ______________________
BLOCK LETTERS PLEASE

Full Address ______________________

____

____

Occupation ______________________

Your Signature ______________________
(Parent to sign if you are under 21)

Tick ✓ where applicable
The address on left is—

My Property	☐
Rented Unfurnished	☐
Rented Furnished	☐
Parents' Home	☐
Temporary Address	☐
Boarding	☐

This coupon is invalid if not signed and all questions answered.

NOW *you can do* every job BETTER, CHEAPER & QUICKER

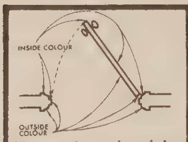
GLAZING. DOUBLE
BUTT JOINTING

EVERYTHING YOU WANT TO KNOW ABOUT—

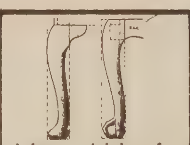
Tiling, Bricklaying and Tools, Cavity Walls, Laying Carpet and Lino, Concrete Mixes, Condensation and Damp-proofing, Roof Repairs, Correct Drainage, Adhesives, Levelling and Painting Floors, Household Pest Control, Home Insurance, Interior and Exterior Decoration, Paint Stripping, Spraying, Painting, Plastering, Plastic Plumbing, Power Tools, Radio and TV Faults, Car Maintenance, Draught-proofing, Electric Wiring, Brickwork, Colour in Decorating, Lighting effects, and so much more—a veritable mine of practical data you need today as never before.

THESE PUT EXTRA VALUE ON YOUR HOME—

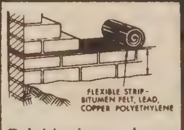
How to Build a Breakfast Bar. Fuel Bunker. Built-in Furniture. Corner Bookcase. Incinerator. Terrace, Drive-way. Front-door Canopy. Covered Way. Dining Serving Hatch. Bathroom Cabinet. Continental Bedheads. Burglar Alarm. Dropside Cot. Laundry Cupboard from wasted space . . . a thousand and one aids to make a cosy home.



How to decide colours for each side of door.



Joinery tricks for all chairs and woodwork.



Bricklaying, damp courses, maintenance, etc.

MAIL THIS POST PAID CARD TODAY

CUT OUT ALONG DOTTED LINE

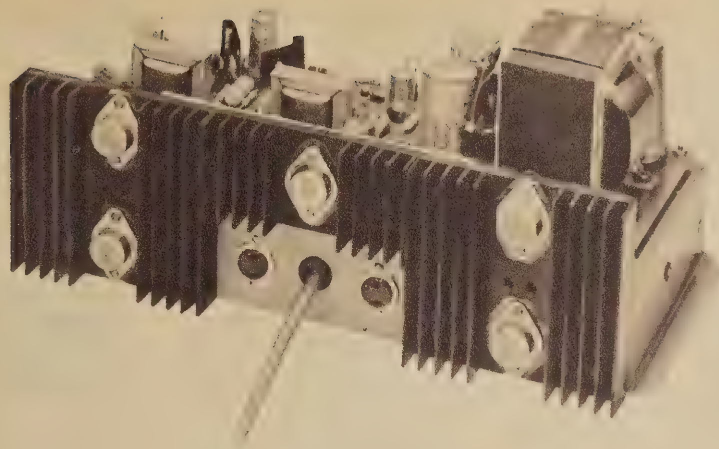
Authority
No. 336
WELLINGTON

BUSINESS REPLY POST

Postage will be paid by

GEORGE NEWNES (NZ) LTD.,

99 THE TERRACE,
P.O. BOX 520,
WELLINGTON, C.1



SPECIFICATION

A fully transistorised stereo power amplifier, featuring output transformerless power stages. The amplifier channels will deliver 8 watts RMS sine-wave into 15-16 ohm loads, and 12 watts RMS sine-wave into 7.5-8 ohm loads, with a frequency response from 25cps—40Kc (—3dB). Total harmonic distortion at 2Kc for full power output across 15 ohms is less than 0.2 per cent.

Hum and noise are 64dB below full output. Channel crosstalk is —30dB at 1Kc.

Input sensitivity for full output is approximately 180mV.

Output impedance is approximately 1.5 ohms, giving a damping factor of approximately 10. Input impedance approximately 100K.

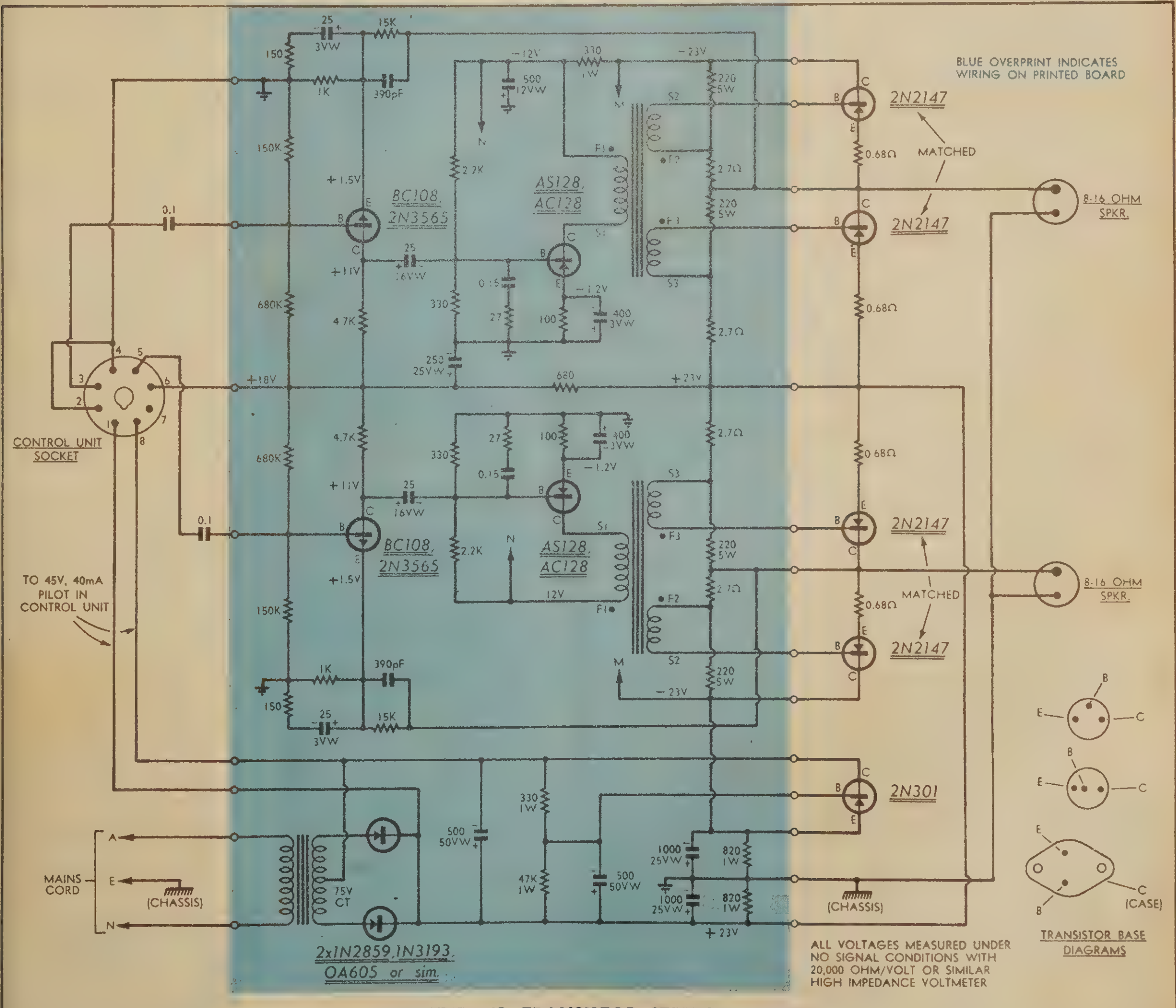
It has been arranged to employ the same printed wiring board, No. 63/A4.

The output stages employ germanium PNP power drift transistors type 2N2147, in the now familiar and popular "single-ended push-pull" output transformerless class-B circuit. The use of emitter transistors and low-impedance bias circuitry gives these stages excellent thermal stability.

The output stages will deliver more than 8 watts RMS into 15 ohm loads under continuous sine-wave conditions. Under the same conditions they are capable of delivering some 12 watts RMS into 7.5 or 8 ohm loads with slightly greater distortion. They will also deliver 12 watts into 3.75 or 4 ohm loads, but the distortion level tends to be somewhat high.

In no circumstances should the amplifier channels be used with load impedances lower than 3.5 ohms, as lower loads may well result in overload and ruin of the output transistors. For the same reason, every care should be taken to prevent short-circuiting the speaker terminals of the amplifier channels while signals are applied.

The drive for the output stages of the amplifier channels is provided by medium-power PNP germanium transistors type AC128 or AS128, connected to


BLUE OVERPRINT INDICATES WIRING ON PRINTED BOARD
25 3VW
15K
150
1K
390pF
500 12VW
330 1W
−12V
−23V
220 5W
2.7Ω
0.68Ω
2N2147
MATCHED
8-16 OHM SPKR.
150K
+1.5V
BC108, 2N3565
AS128, AC128
2.2K
0.1
+11V
25 16VW
0.15
27
100
−1.2V
400 3VW
680K
4.7K
250 25VW
+18V
680
+23V
CONTROL UNIT SOCKET
TO 45V, 40mA PILOT IN CONTROL UNIT
S1
S2
S3
F1
F2
F3
M
N
12V
2N301
330 1W
47K 1W
500 50VW
1000 25VW
820 1W
MAINS CORD
A
E
N
(CHASSIS)
75V CT
2x1N2859, 1N3193, OA605 or sim.
ALL VOLTAGES MEASURED UNDER NO SIGNAL CONDITIONS WITH 20,000 OHM/VOLT OR SIMILAR HIGH IMPEDANCE VOLTMETER
B
E
C
(CASE)
TRANSISTOR BASE DIAGRAMS

PLAYMASTER 113 TRANSISTOR STEREO AMPLIFIER

☐ CAR RADIO AERIALS

Lock type — recess into cowl. Can only be raised with key. L3—3 pieces. Fully raised height 37in. Depth below cowl 10½in. **$6.50 (65/-)**

L4—4 piece. Fully raised height 44½in. Depth below cowl 16½in. **$6.75 (67/6)**

Plus pack and post 15c (1/6) either of above.

☐ EVERCEL PLASTIC INSULATING TAPE

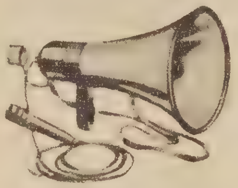
¾in. x 15yds. Supplied in dispenser with cutter. Colours Green, Red, Black. **48c (4/9)**

Post Free

● TELECOMPONENTS

Television replacement transformers. Vast range in stock. Call or write for lists.

LOUD HAILERS



Weight, 3½lb. Range up to 1,000 yards. CARDIOID MICROPHONE — may be detached at will. UNBREAKABLE — SHOCKPROOF — WEATHERPROOF. Useful for: Life-savers, Coastguards, Scouts, Sporting Events, Building Construction, Fairs, Shows, Supermarkets, etc.

$59 (£29/10/-)

inc. Batteries and Freight

☐ SILICON DIODES

18 amps at 50 PIV — available with either K or A to case. **95c (9/6 each)**

1 amp. at 1000 PIV. **$1.65 (16/6 each)**

Post Free

☐ World famous POLYPAKS 1 Dollar (10/-)

Famous 1 dollar paks — brand new — no "rubbish." Ideal for amateurs, beginners, servicemen, enthusiasts.

1. 30 carbon resistors, asst. ½ watt and 1 watt, presets too. 1 dollar (10/-).
2. 20 asst. capacitors, 5 each paper, plastic, mica, ceramic. 1 dollar (10/-).
3. 20 silver mica capacitors, inc. 5 per cent values. 1 dol. (10/)-.
4. 20 styroseal plastic capacitors, 20 per cent and 10 per cent. 1 dollar (10/-).

Guaranteed A1 quality Popular brands. 1 pak, postage 4c (5d.); 3 paks, post free.

☐ RECORD CLEANER KITS

Mounts on Turntable and tracks in front of the stylus, removing dust, etc. **$3.50 (35/-)**

Post Free

☐ PICTURE TUBE BOOSTERS

Give your picture tube a new lease of life by installing an easily fitted booster. If your picture lacks contrast and brightness you need a picture tube booster. When ordering state whether 70, 90 or 110 deg. or the type number of the tube.

70° & 90° type — $3.50 (35/-)

110° type — $3.85 (38/6) **Post Free**

WARBURTON FRANKI

WF

☐ MULTIMETERS

Well known type 200H. Fan shaped meter movement.

RANGES:

D.C. volts—5, 25, 50, 250, 500, 2500 at 20,000 o.p.v.
A.C. volts—10, 50, 100, 500, 1000 at 10,000 o.p.v.
D.C. Current—50 U.A., 2.5 M.A., 250 M.A.
Resistance—.6K, .6 megohm.
Capacitance—10 PF to .1 MFD.
Decibels—Minus 20 to plus 22.
Supplied in box with leads and battery.

$11 (£5/10/-) **Post Free**

☐ PHILIPS ELECTRONIC ENGINEER ASSEMBLY KITS

KIT No. EE8 PARTS FOR 8 PROJECTS

Morse Code Practice Set, Gramophone Amplifier, 1 Transistor Radio, Moisture Indicator, Traffic Beacon, Burglar Trap, 2 Transistor Radio, Automatic Night Light. **$19.95 (£9/19/6)**

KIT No. EE20 PARTS FOR 20 PROJECTS

All the above plus: Electronic Organ, Audio Amplifier, Intercom., Bi-Ampli Amplifier, Detective's Ear, Pilfering Alarms, Push-Pull Amplifier, Universal Test Circuit, Morse Code Trainer, Time Switch, 3 Transistor Radio, Acoustic Relay. **$29.95 (£14/19/6)**

KIT No. EE8/20 COMPLIMENTARY KIT

When added to EE8 equals EE20. **$13.95 (£6/19/6)**

Plus Pack & Post. 10c (1/-)

☐ MAGNAVOX SPEAKERS

All models available from stock.
Write or call for Data Sheet.
HF5SIC Tweeter—7.5 or 15 ohm.
$5.20 (52/-)

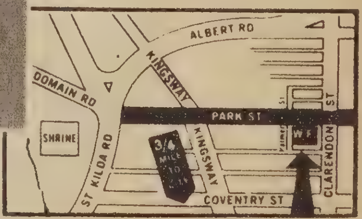
6WR 7.5 or 15 Ohm	**$13.15 (£6/11/6)**
8WR 2.7 or 15 Ohm	**$14.25 (£7/2/6)**
12WR 2.7 or 15 Ohm	**$15.25 (£7/12/6)**

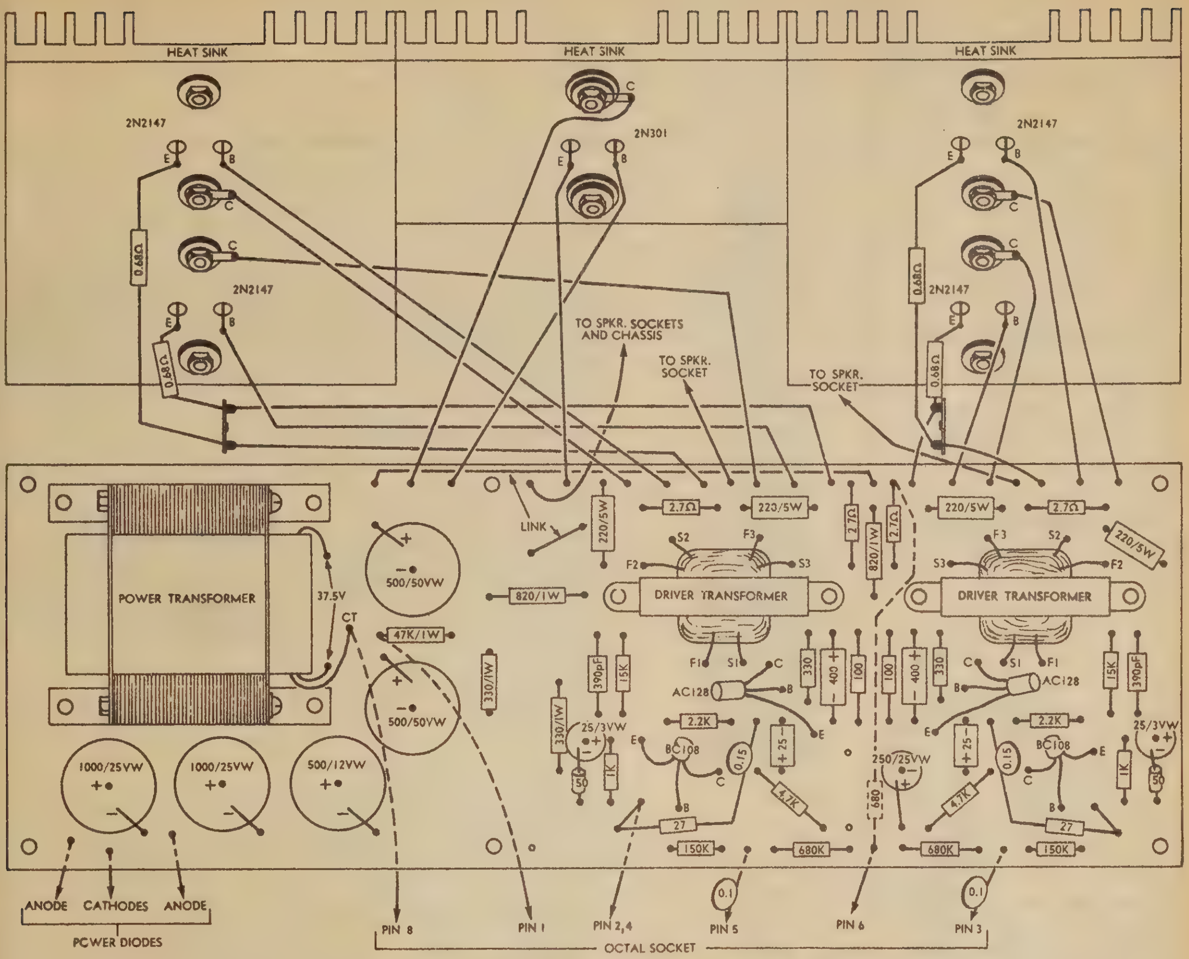
Post Free

WF **WARBURTON FRANKI**

220 PARK ST., STH. MELB., VIC. - - 69-0151

● Please include postage and freight with all orders. ● Trade also supplied




HEAT SINK
HEAT SINK
HEAT SINK
2N2147
2N301
2N2147
E
B
C
0.68Ω
2N2147
2N2147
TO SPKR. SOCKETS AND CHASSIS
TO SPKR. SOCKET
TO SPKR. SOCKET
POWER TRANSFORMER
37.5V
CT
500/50VW
500/50VW
LINK
220/5W
2.7Ω
820/1W
47K/1W
330/1W
DRIVER TRANSFORMER
DRIVER TRANSFORMER
F1
F2
F3
S1
S2
S3
AC128
BC108
390pF
15K
25/3VW
1K
50
2.2K
0.15
25
4.7K
27
150K
680K
330
400
100
250/25VW
680
1000/25VW
1000/25VW
500/12VW
ANODE
CATHODES
ANODE
POWER DIODES
PIN 8
PIN 1
PIN 2,4
PIN 5
PIN 6
PIN 3
0.1
OCTAL SOCKET

Using this wiring diagram it should be easy to duplicate the prototype amplifier.

the output stages via small driver transformers. The transformers have a turns ratio of 2.5:(1+1), and handle less than 10 milliwatts; a suitable type is the Ferguson TRD223 or its equivalent in other brands.

Preceding the driver stages and forming the input stages of the channels are common-emitter voltage amplifier stages employing NPN silicon transistors type 2N3565 or BC108 or similar. Silicon transistors are used here in order to provide a relatively high input impedance of approximately 100K.

The use of heavy negative feedback (approx 40dB at 1KC) around the amplifier channels contributes markedly to the low distortion figures attained. Feedback is applied to the input stage emitters from the voice-coil circuit via 15K resistors shunted with 390 pF phasing capacitors.

Two step circuits are used in each channel to ensure satisfactory AC stability. Low frequency step circuits (25uF in series with 150 ohms) in the input stage emitter circuits reduce the gain at low frequencies, while high frequency step circuits (0.15uF in series with 27 ohms) in the driver base circuits produce a similar drop at high frequencies. The overall stability is such that more than 0.1uF must be connected across a 15 ohm load to produce marked ringing on square waves, and more than 0.33uF to produce spontaneous oscillation.

In short, despite the heavy AC feedback, there should be ample stability margin for all applications.

The sensitivity of the amplifier channels is quite high, less than 180mV input being required for full output at 1KC. Frequency response is approximately 25cps—40KC between 3dB down points, at a power level of 7 watts. Total harmonic distortion at 8 watts output across 15 ohms at 2KC is less than 0.2 per cent, and output noise is approximately 64dB below full output. Channel crosstalk at 1KC is approximately -30dB. Output impedance is close to 1.5 ohms.

The power supply for the amplifier

PARTS LIST

1 Chassis, 12in x 5½in x 2in, with aluminium plates 6in x 2in and 2in x 1½in.
1 Printed wiring board, 63/A4.
3 Finned radiator blocks, two 4in x 4in (type 7001 or similar) and one 4in x 2in (type 7000 or similar).
1 Power transformer, 240V to 75V CT at 750mA, with copper strap for low external leakage.
2 Driver transformers, ratio 2.5:(1 plus 1).

TRANSISTORS, DIODES

2 pairs matched 2N2147 power transistors.
2 AC128 or AS128.
2 2N3565, BC108 or similar.
2 1N2859, 1N3193, OA605 or similar.

RESISTORS

Half-watt, 5 per cent: 4 x 0.68 ohm, 4 x 2.7 ohm, 2 x 27 ohm, 2 x 100 ohm, 2 x 150 ohm, 2 x 330 ohm, 1 x 680 ohm, 2 x 1K, 2 x 2.2K, 2 x 4.7K, 2 x 15K, 2 x 150K, 2 x 680K.
One-watt types: 2 x 330 ohm, 2 x 820 ohm, 1 x 47K.
4 x 220 ohm 5 watt.

CAPACITORS

2 x 390pF plastic.
2 x 0.1uF LV plastic or ceramic.
2 x 0.15uF LV plastic or ceramic.
2 x 25uF 3VW electrolytic.
2 x 25uF 16VW electrolytic.
1 x 250uF 25VW electrolytic.
2 x 400uF 3VW electroyltic.
1 x 500uF 12VW electrolytic.
2 x 500uF 50 VW electroyltic.
2 x 1000uF 25VW electrolytic.

MISCELLANEOUS

Octal socket: two polarised two-pin sockets with matching plugs; 3 x miniature 3-lug tagstrips, two 4-lug sections miniature strip; 3-terminal block of "BB" connector strip; mains cord and plug; scrap aluminium for cord clamp; nuts, bolts, insulating washers and sleeving, connecting wire, solder, etc.

COUPON

Please forward free illustrated literature and specifications

Wm. J. McLellan & Co. Pty. Ltd.
THE CRESCENT, KINGSGROVE, N.S.W. 50-0111
S366

Name ....

Address ....

My usual supplier is ....

SPEED

Six!! Yes, only 6 seconds initial heat-up time from cold, then practically instantaneous.

CONTROL

Temperature control at your finger-tips with the exclusive "Switch-Ring." Heat only where, when, and as much as needed.

CONVENIENCE

Ideal for inaccessible spots. No burning of adjacent insulation or parts. Eminently suitable for a thousand and one soldering JOBS.

LABOUR SAVING

Instant warm-up—always ready. No waiting for cool-off. No over-heating. Eliminates wiping, re-tinning and filing of tips to minimum.

ECONOMY

One Scope Iron does work of several. Consumes current only whilst in use. No expensive parts to replace. Supplied complete set of spare tips and plastic pouch-pack, with Deluxe iron.

VERSATILITY

Solders widest range of connections—small or large. Standard and Deluxe out-perform other irons up to 150 WATT rating.

LESS MAINTENANCE

Longer tip life—no expensive heating elements to replace. "Switch-Ring" has no metal to metal contacts to burn out or become high resistant with time.

VARIETY

Scope offers three great models from which to choose.

Standard	Price 55/- ($5.50)
Deluxe	Price 59/6 ($5.95)
Miniscope	Price 52/6 ($5.25)

THE WORLD'S FASTEST HEATING SOLDERING IRON

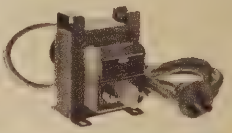
Scope Soldering Irons are designed on an entirely NEW principle —ensuring fast, accurate operation. Scope is eminently suitable for a thousand-and-one soldering jobs—ideal wherever the fastest heat transfer is essential, and can be used in cases where a higher than normal soldering temperature is required.

Scope conveniently operates on voltages from 2.5 V. to 6.3 V., A.C., or D.C., or 4 and 6 V. accumulator, or from 240 V. A.C. mains through a "National" Scope Transformer.

SCOPE

NEW NATIONAL TRANSFORMER

For full protection insist on a "NATIONAL" Scope Iron Transformer, the only transformer approved by the iron manufacturer to ensure full operating efficiency. Fitted with 6 ft. of 3-core flex and 3-pin mains plug. Price: $6.70 (67/-).



AVAILABLE ALL ELECTRICAL TRADE SUPPLY HOUSES AND HARDWARE STORES
THE FULL GUARANTEE APPLIES WHEN IRON IS USED WITH A NATIONAL TRANSFORMER

AUSTRALIAN & OVERSEAS AGENTS:
Wm. J. McLELLAN & CO. PTY. LTD.
THE CRESCENT, KINGSGROVE, N.S.W. 50-0111

VICTORIA:
A.E.E. CAPACITORS PTY. LTD.
202 BELL STREET, PRESTON. 44-0491

TASMANIA: W. P. MARTIN PTY. LTD.
202 Argyle Street. HOBART

S. AUSTRALIA: COLLETT & CANT PTY. LTD.
103 Halifax Street, ADELAIDE

N.Z.: H. W. CLARKE (N.Z.) LIMITED
42-46 Cable Street, WELLINGTON, C.3

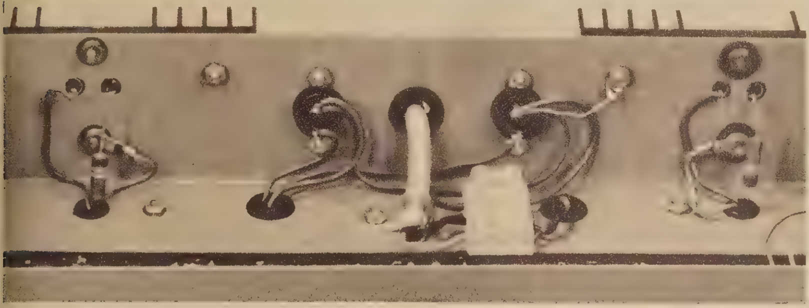
N.Z.: H. W. CLARKE (N.Z.) LIMITED
10 Teed St., New Market, AUCKLAND, S.E.1

W. AUSTRALIA: I. W. HOLMAN & CO.
249 James Street, PERTH

QUEENSLAND: K. H. DORE & SONS
505-507 Boundary Street, BRISBANE
ALSO TOWNSVILLE AND ROCKHAMPTON

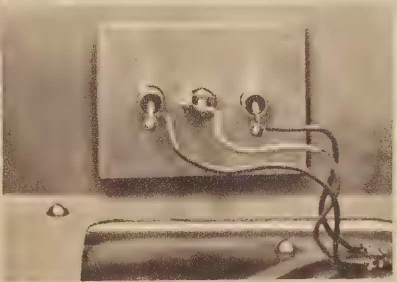
channels employs a full-wave rectifier circuit with two low voltage silicon diodes type 1N2859, 1N3193, OA605 or similar. The rectifier section is followed by a capacitance multiplier dynamic filter stage employing a 2N301 germanium power transistor. The output of this stage is centre-tapped with respect to ground, supplying both -23V and +23V to the amplifiers.

The -23V line supplies power to the AC128 driver transistors and to one of each pair of the output transistors. The +23V line is used to supply the remaining output transistors, the input stages and the control unit.



An underneath rear view of the chassis, showing the speaker sockets, the mains cord entry, and the lower power transistors.

Please note that for use with this amplifier the 112 Control Unit must be modified slightly from the circuit shown in the original article for use with valve control units. The 22K 5W power line series resistor should be changed to 470 ohms 1W, and the two zener diodes should be replaced by a single 100uF 16VW electrolytic capacitor.



Above, a detail shot of the input connector socket and wiring. At right is a close-up of the rectifier diode heat-sink.

In addition, the neon pilot lamp originally specified must be replaced with a low-wattage incandescent lamp of the miniature "No. 2 Telephone Switchboard" variety.

Use either a 45V 40mA type, or a 50V 100mA type in series with a 330 ohm 2W resistor. The narrow bulb of these lamps will fit inside a standard 3-8in diameter threaded bezel, while the current drain involved is compatible with the low voltage power supply in the new amplifier.

From the amplifier circuit it may be seen that power for the Control Unit pilot is taken directly from the rectifier output to lugs 1 and 8 of the connector socket. Thus in the Control Unit the pilot circuit should be disconnected from the preamp supply line and taken independently to pins 1 and 8 of the output plug.

As mentioned earlier the new amplifier has been arranged to use the existing 63/A4 printed wiring board. The board mounts all components apart from the power transistors and their emitter resistors. The power transistors are mounted on extruded heat-sink radiators which are bolted to the side of the chassis, with the emitter resistors supported by miniature 3-lug tagstrips adjacent to the transistors.

The board measures 4in x 11½in and the chassis 5½in x 12in x 2in. The heat-sink radiators for the two pairs of output transistors measure 4in x 4in x ¾in, and that for the dynamic filter transistor measures 4in x 2in x ¾in. The board mounts on the chassis via six bolts and nuts to give 3/16in spacing. The dynamic filter transistor radiator is attached to the larger radiators via a 6in x 2in plate made from scrap aluminium.

The position and wiring of the minor components should be quite plain from the photographs and wiring diagram. Using these and the circuit diagram it should be an easy matter to construct the amplifier. However, there are a few points which should be noted.

The power transistors are electrically insulated from the heat-sink radiators but are mounted so that the heat generated within them is quickly conducted to the radiators. As the auxiliary diagram shows this involves thin mica washers and insulating bushes over the mounting screws.

For optimum heat transfer the mica washers should be lightly smeared with silicon grease to exclude air bubbles. Before connecting the power transistors into circuit it is a wise plan to check that they are insulated from the heat-sink and chassis with an ohmmeter or other continuity tester. This can prevent possible ruin of the costly transistors due to a tiny burr or whisker of metal.

The silicon rectifier diodes are operated at close to their maximum current rating, and are clamped to the end of the chassis for cooling. Here again the mounting involves electrical insulation

ORYX
World-famous miniature Soldering Instruments

NO SWITCH NECESSARY WITH ORYX —
The element is rated for continuous running, thus avoiding switch troubles and warming-up delays.

Weighs less than 1 oz. yet does the work of heavy irons. Long-life element and replaceable bits ensure years of service. There's an ORYX designed to meet your precise requirements.

Australian Distributors
MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 York St., Sydney. 2 0233, Ext. 279.
M.488

Tested, off-the-shelf amplifiers for any application

Newmarket pre-assembled Packaged Circuit Amplifiers have been developed to provide standardised starting points in the design of all types of equipment in which amplifiers fulfil a major role. Six are at present available from stock and others are in course of development. Their use saves expensive, time-consuming research, thus cheapening the production of new types of electronic equipment.

Recently released is the PC9 impedance matching A.F. pre-amplifier. It has been specifically designed to enable a high impedance capacitive source to be fed into the relatively low impedance amplifiers PC2, PC3, PC5 and PC7+. An abridged specification is listed below.

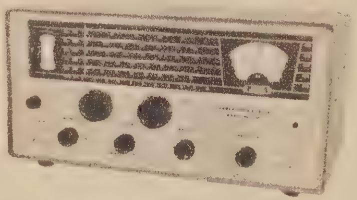
SUPPLY VOLTAGE: 9V.
INPUT IMPEDANCE: Typically 600 ohms.
FREQUENCY RESPONSE: Flat from 20 cps to 20 kc/s (± 3db) at 1 kc/s level.
SIZE: 1.4" x 1.25" x .5". WEIGHT: 7 grams. **Price: £3/5/-**

SPECIFICATION DETAILS

A typical miniature Audio-Amplifier is illustrated actual size above. Circuits are of transformerless, complementary symmetry type, operating off Standard Voltages. Can be wire-in or plug-in as required.

PERFORMANCE DATA	PC1	PC2	PC3	PC4	PC5+	PC7+
Power Output (RMS)	150mW	400mW	400mW	400mW	3W	0.8W
Input Sensitivity (Full output)	100mV	2mV	10mV	200mV	5mV	5mV
Input Impedance (Typical)	1.5K	1K	2.5K	220K	1.5K	1.5K
Load Resistance (Ohms)	40	15	15	15	3	8
Supply Voltage (Nominal)	9V	9V	9V	9V	12V	9V
Total Distortion (Full output)	6%	6%	6%	6%	3%	3%
Frequency Response	330 c/s —15Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	50 c/s —15Kc/s	50 c/s —15Kc/s
Overall Dimensions (Inches) All ¾in. high.	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾
PRICE	**£3/2/6**	**£3/15/**	**£3/15/**	**£3/15/**	**£8**	**£4/15/**

PALACE MODEL HCR-62 PROFESSIONAL QUALITY 4-BAND AMATEUR COMMUNICATION RECEIVER



£62/10/- plus sales tax

PALACE HCR-62 is one of the world's most advanced Amateur Communication Receivers designed and manufactured to meet the exacting requirements of amateurs in this advanced electronic age. The bandset and bandspread dials are fitted with large fly-wheels for smooth tuning with minimum back-lash. One RF stage and two IF stages ensure high sensitivity and selectivity. Excellent selectivity has been achieved by the use of back-to-back intermediate frequency transformers in the IF amplifier stages. The vertical S meter is connected in a bridge circuit which maintains stable operation.

Special terminals are provided on the rear chassis for connection of a Q5er for double superhet action. The output frequency of this connection is 455KC.

SPECIFICATIONS:
FREQUENCY RANGE:

Band 1	540-1605 KC
Band 2	1.6-4.8 MC
Band 3	4.8-14.5 MC
Band 4	10.5-30 MC

BAND SPREAD:

3.5 MC Band	3.5-3.575 MC
7 MC Band	7.0-7.14 MC
14 MC Band	14.0-15.2 MC
21 MC Band	21.0-21.9 MC
28 MC Band	28.0-30.2 MC

CONTROLS:

1. AF Gain (Volume Control) with Power-Off Switch.
2. Function Switch (Manual Volume Control, Automatic Volume Control, and CW-SSB)
3. Main Tuning.
4. Band Spreader.
5. B.F.O. Pitch Control.
6. A.N.L. (Automatic Noise Limitor) (On-Off.
7. Sensitivity Control (for gain control on R.F. and I.F. Amplitude)
8. Band Selector (4 bands position)
9. Receive-Standby Switch.
10. S-Meter Zero Adjuster.
11. Headphone Jack.

SELECTIVITY:—60 dB at ± 7 KC detuning.
SENSITIVITY: 3 uV (S/N 20dB at 10 MC)
TUBE COMPLEMENTS: 6BA6 x 4, 6BE6 x 1, 6AL5 x 1, 12AT7 x 1, 6AR5 x 1, 5Y3GT x 1.
SIZE: 17" (W) x 8½" (H) x 10-3/4" (D)
WEIGHT: 26 lbs.

MODEL DH-100 EXTENSION SPEAKER FOR HCR-62 RECEIVER

DH-100 is specially designed desk wall-hang type speaker matching with HCR-62 Communication Receiver. Minutely finished rugged metal housing with pipe stand, assuring rich tone and power.

SPECIFICATIONS:
OUTPUT POWER (max.): 3W
FREQUENCY RESPONSE: 250-6000 c.p.s.
VOICE COIL IMPEDANCE: 4 ohm.
SIZE: 5-1/4" (Dia.) x 5-½" (Depth).
WEIGHT: 1.5 lbs.

MODEL No. PC 1
Stethoscope Amplifier.
General Purpose Audio Amplifiers and Drivers.
Intercomm Amplifier.
Telephone Amplifiers.
Laboratory Instrument Amplifiers.
Back Projector Audio Amplifiers.
Loudspeaker Amplifier.
Hospital Board Control Units Intercomm Amplifiers.

MODEL No. PC 2
Modulator Driver Stage.
Intercomm.
Church Hearing Aid Amplifier.
Office Dictating Machines.
Door-Caller Monitor Amplifier.
Inter-Office Communication Amplifier.
Tape Replay Amplifier.
General Purpose Audio Amplifiers and Drivers.
Telemetry Audio Amplifier.
Radio Receiver Audio Amplifier.
Telephone Amplifiers.
Educational Equipment Audio Amplifiers.
Laboratory Instrument Amplifiers.
Language Laboratory Amplifiers.
Tape Recording Amplifiers.
TV Aerial Riggers Intercomm Amplifier.
Loudspeaker Amplifier.
Radio Concentrator.
Mine Communication Amplifier.

MODEL No. PC 3
Disc Talking Book.
DC Relay Driver.
Telecommunications Conference Monitor Amplifier.
Sound-level Meter Amplifier.
Close Background Music Amplifier.
Sound Reinforcement Amplifier.
General Purpose Audio Amplifiers and Drivers.
Low Power Battery Stereo.
VHF Communications Receiver Audio Amplifier.
Radio Receiver Audio Amplifier.
Radio Relay System Amplifier.
Loudspeaker Amplifier.

MODEL No. PC 4
Battery Record Player.
General Purpose Amplifiers and Drivers.
Office Dictating Machines.
Telephone Amplifiers.
Pay TV Control Circuits Amplifier.
Stereo Listening Booth Amplifiers.
Laboratory Instruments Amplifiers.

MODEL No. PC 5 Plus
Salesman's Portable Cine Projector Audio Amp.
Meter Type Galvanometer Amplifier.
Helmet Intercomms: (a) Diving Suits. (b) Crash Helmets. (c) Pilots' Helmets.
Car Radio Audio Amplifier.
Communications Receiver Audio Amplifier.
Lecturer Non-Interruption Monitor.
Erotogenic Amplifier.
Small public Address Portable Amplifier.
Servo Amplifier (Hydraulic valve control).
General Purpose Amplifier.
Fault Finding Tone Detector Amplifier.
Tape Replay Amplifier (Aircraft ground equipment).
Automation Drive Amplifiers.
Colour Television Receiver Audio Amplifier.
Tape Recorder Replay Amplifier.
Hi-Fi Amplifier.
Vibration Test Amplifiers.
Mines Telephones Amplifiers.
Cigarette Manufacturer Production Test Equipment Amp.

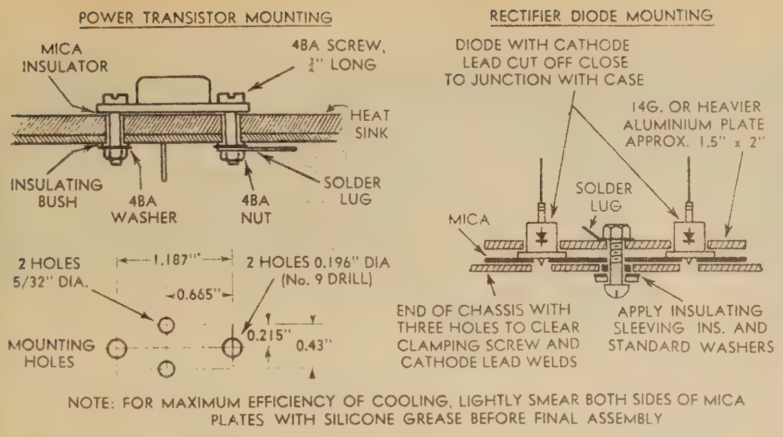
For prices write to:—

GENERAL ACCESSORIES

Trade Enquiries Invited

116-118 Clarence Street, Sydney. BX-4451
443 Concord Road, Rhodes. 73-0211
102 Northumberland Street, Liverpool, 602-7570.
7 Pirie Street, Fyshwick, A.C.T. 90035

PLEASE NOTE: CLARENCE ST., CITY, AND LIVERPOOL STORES ARE OPEN SATURDAY MORNINGS.


POWER TRANSISTOR MOUNTING
MICA INSULATOR
4BA SCREW, ½" LONG
HEAT SINK
INSULATING BUSH
4BA WASHER
4BA NUT
SOLDER LUG
2 HOLES 5/32" DIA.
1.187"
0.665"
2 HOLES 0.196" DIA (No. 9 DRILL)
0.215"
0.43"
MOUNTING HOLES
RECTIFIER DIODE MOUNTING
DIODE WITH CATHODE LEAD CUT OFF CLOSE TO JUNCTION WITH CASE
14G. OR HEAVIER ALUMINIUM PLATE APPROX. 1.5" x 2"
SOLDER LUG
MICA
END OF CHASSIS WITH THREE HOLES TO CLEAR CLAMPING SCREW AND CATHODE LEAD WELDS
APPLY INSULATING SLEEVING INS. AND STANDARD WASHERS
NOTE: FOR MAXIMUM EFFICIENCY OF COOLING, LIGHTLY SMEAR BOTH SIDES OF MICA PLATES WITH SILICONE GREASE BEFORE FINAL ASSEMBLY

Details of the power transistors and rectifier diode mounting arrangements. Note that both transistors and diodes are electrically insulated from the chassis.

via a thin sheet of mica and plastic sleeving, and it is advisable to check the diode-chassis insulation with a continuity tester before applying power.

The driver transistors must be provided with small "flag" type heat radiators, to provide a small measure of additional cooling. These are normally available at no extra charge with the transistors, as are the mica washers with power transistors.

When mounting resistors and capacitors to the printed board, allow an eighth of an inch or so when bending pigtails close to the component body and do not bend the pigtails too sharply. This reduces the risk of component damage. It is also a good plan to use a pair of long-nose pliers gripping the pigtails as a heat-sink when soldering.

As a result of adapting the new circuit to an existing printed board pattern there are one or two cases where two components are connected above the board in mid-air. Make sure that these joints are solidly made to prevent future failure. Note also that the 680 ohm resistor supplying the input transistors from the +23V line is mounted beneath the board; one pigtail is extended using tinned copper wire, insulated with plastic or varnished cambric sleeving.

A further small point to note in this regard is that the input transistor emitter leads no longer connect to the original holes marked "E" on the copper side of the board.

The large electrolytic capacitors in the power supply are mounted on end. As their upper pigtails are too short to reach the board they are terminated on small sections of miniature tagstrip, and insulated wires taken down to the board.

There is only one connection between the printed board earth (which is also the Control Unit earth) and the chassis and mains earth; this is at one speaker socket. Single point earthing ensures that earth loops cannot form to prejudice stability or cause hum.

The speaker sockets are of the polarised two-pin type. Sockets are used in preference to screw terminals to reduce the risk of accidental shorting of the outputs. Polarised sockets are used to ensure that speaker phasing remains constant despite temporary plug removal.

The mains cord is terminated in a three-section "B-B" connector block underneath the chassis, the primary leads of the power transformer being taken directly to this block along with a wire from the chassis and speaker earth connection. The mains cord is clamped to the chassis upon entry through the grommeted hole, using a small "P" bracket made from scrap aluminium.

A small three-lug tagstrip adjacent to the Control Unit socket is used to support the 0.1uF input coupling capacitors. Please note that the Control Unit earth connections are NOT taken to the tagstrip; nor are they taken to the chassis, but connect directly to the earth conductor of the board as near as possible to the socket.

The board wiring diagram shows the transformer connections for the driver transistors, with "S" and "F" used to indicate the starts and ends of the various windings. The manufacturer's data sheet should be used to determine the wires involved.

If the foregoing instructions are followed carefully, the amplifier should work perfectly as soon as it is completed and connected to the rest of the system and the mains. It should be mounted in the cabinet so that air can flow freely past the radiator fins for efficient cooling.

If the amplifier channels upon switch-on produce a loud squeal, switch off immediately and reverse the connections to the appropriate driver transformer primary winding (S1 and F1); the manufacturer's wire colour coding is most likely in error. Similarly, if little or no output is obtained, try reversing one of the secondary windings (this may also mean reversing the primary to stop oscillation).

There you have it, then: a high quality but inexpensive transistor stereo amplifier which should give years of trouble-free reproduction. We think that it will prove to be a very worthy companion to our new Control Unit and Bookshelf enclosures, and a popular choice among audio enthusiasts.

There will no doubt be, as always, a few purists for whom the amplifier will fall a little short of their ideals. Possibly we may be able to cater for these people with a future "no holds barred" design, if time permits and there seems to be sufficient interest. No promises, though!

FOR PRINTED CIRCUITS
CONTACT
Precision Windings

TRADE — RESEARCH — HOBBYISTS

- FOR QUICK SERVICE
- ANY QUANTITY
- EVERY BOARD GUARANTEED
- INDIVIDUAL QUOTES FOR PRODUCTION RUNS
- COMPONENT LOCATION SCREENING AVAILABLE
- WE MEET YOUR SPECIFICATION
- GOLD PLATE RESIST
- SINGLE AND DOUBLE SIDED
- PHENOLIC PAPER EPOXY PAPER EPOXY GLASS ALL AVAILABLE
- ACCURATE DRILLING AND BLANKING
- YOUR DRAWING CONVERTED TO A CIRCUIT
- PHOTOGRAPHIC COST $3.00
- PHENOLIC PAPER 5c PER SQ. IN.
- EPOXY PAPER 8c PER SQ. IN.
- EPOXY GLASS 10c PER SQ. IN.
- NO OTHER SETTING UP CHARGE
- ARTWORK AIDS AVAILABLE

OUR EFFICIENCY ENSURES HIGH QUALITY AT LOW COST

PRECISION WINDINGS
546 7820
52 CAMBRO ROAD,
CLAYTON, VICTORIA.

FAIRCHILD AUSTRALIA PTY. LTD., 46 Caroline Street, So. Yarra S.E. 1, Victoria / Subsidiary of Fairchild Camera and Instrument Corporation, U.S.A

LINEAR AND ANALOG INTEGRATED CIRCUITS

Integrated circuits for linear and analog applications are now a reality. Fairchild offers you eight different circuits to suit your individual application and temperature requirements. These circuits feature Planar epitaxial construction and high performance characteristics which equal or exceed the performance of most discrete circuits. Fairchild integrated linear and analog circuits are available, ex-stock, for immediate delivery. Write for our data sheets, or phone for full information.
Call 26 6664, South Yarra, or 43 1537, Sydney.

FAIRCHILD
AUSTRALIA PTY. LTD.

μA702A μA702C/OPERATIONAL AMPLIFIERS

Features:

Low input offset	2mV
High voltage gain	2600
Wide frequency range	DC to 30Mc
Low thermal drift	5μV/°C
Large output swing	±5.3V

Guaranteed temperature range:

μA702A	−55°C to +125°C
μA702C	0°C to +70°C

Price (in Australian dollars)*

		1-24	25-99	100 (mixed)	100 (single)
μA702A	A$	27.00	21.60	18.90	18.00
μA702C	A$	18.00	14.40	12.60	12.00

Applications: High speed analog computers; precision instruments; Feedback amplifier applications.

μA709 μA709C/OPERATIONAL AMPLIFIERS

Features:

Common mode range	±10V
Voltage gain	45,000
Output swing	±13V @ 5mA
Offset voltage	1mV
Thermal drift	3μV/°C
Offset current	50nA
Power supply rejection	25μV/V
Power consumption	80mW

Guaranteed temperature range:

μA709	−55°C to +125°C
μA709C	0°C to +70°C

Price (in Australian dollars)*

		1-24	25-99	100 (mixed)	100 (single)
μA709	A$	45.00	36.00	31.50	30.00
μA709C	A$	30.00	24.00	21.00	20.00

Applications: Operational amplifier in high-impedance analog computers; DC servo systems; low-level instrumentation; special linear and non-linear transfer functions.

μA710 μA710C/DIFFERENTIAL COMPARATORS:

Features:

High accuracy	±2mV
Fast response time	40nsec.
Output compatible with all logic forms	+3.2V to −0.5V
Large input voltage range	±5V

Guaranteed temperature range:

μA710	−55°C to +125°C
μA710C	0°C to +70°C

Price (in Australian dollars)*

		1-24	25-99	100 (mixed)	100 (single)
μA710	A$	27.00	21.60	18.90	18.00
μA710C	A$	18.00	14.40	12.60	12.00

Applications: Level detector; voltage comparator; pulse shape restorer; oscillator, etc.

μA711 μA711C/SENSE AMPLIFIERS/DUAL COMPARATORS

Designed primarily as a sense amplifier, the μA711 is a dual μA710 with outputs OR'ed and with independent strobing on each channel. Output and strobe are compatible with all integrated logic forms. Several units can be wire OR'ed at the output.

Features:

High accuracy	1mV
Fast strobe operation	12nsec.
Fast response time	40nsec.
Low power consumption	130mW
Large input voltage range	±5V

Guaranteed temperature range:

μA711	−55°C to +125°C
μA711C	0°C to +70°C

Price (in Australian dollars)*

		1-24	25-99	100 (mixed)	100 (single)
μA711	A$	45.00	36.00	31.50	30.00
μA711C	A$	30.00	24.00	21.00	20.00

Applications: Coincident current or biax memory sense amplifier; window discriminator; pulse width modulator.

PLANAR: A PATENTED FAIRCHILD PROCESS

*Add 25% tax where applicable.

"What I could really use in this circuit is...

For economy, General Electric silicon power semiconductors

1. Power Thyristor (Silicon Controlled Rectifier) **C6**......1A @ TC=85°C/200V
2. Power Thyristor (SCR) **C20**..........................4.7A @ TC=65°C/400V
3. Power Thyristor (SCR) **C30**..........................16A @ TC=70°C/400V
4. Power Diode **A40**....................................20A @ TC=110°C/600V

For high voltage, General Electric silicon power semiconductors

5. Power Thyristor (SCR) **C145**.......................35A @ TC=80°C/1300V
6. Power Thyristor (SCR) **C150**.......................70A @ TC=75°C/1300V
7. Power Thyristor (SCR) **C180**.......................150A @ TC=90°C/1300V

For high speed, General Electric silicon power semiconductors

8. Signal Thyristor (Silicon Controlled Switch) **13B**....IGTC=1 uA; IH=.2MA
9. High-Frequency Power Thyristor **C140**.............16A @ TC=70°C/400V
10. High-Frequency Power Thyristor **C155**.............70A @ TC=70°C/500V
11. High-Frequency Power Thyristor **C185**............150A @ TC=90°C/600V
12. Silicon Power Transistor **6B**......................60W @ TC=100°C/120V
13. Silicon Power Transistor **20A**.....................30W @ TC=100°C/80V
14. Silicon Power Transistor **7A-T**....................4-40W @ TC=25°C/200V

For proved, industry-standard types, General Electric silicon power semiconductors

15. Power Thyristor (2N1595-99) **C5**...................1A @ TC=100°C/400V
16. Power Thyristor (2N1770A-77A) **C10**.............4.7A @ TC=105°C/400V
17. Power Thyristor (2N681-92) **C35**...................16A @ TC=65°C/800V
18. Power Thyristor (2N1909-16) **C50**.................70A @ TC=75°C/900V
19. Power Thyristor (2N2542-48) **C80**................150A @ TC=80°C/800V
20. Power Thyristor **6RW75**..........................300A @ TC=80°C/1000V
21. Power Diode **A70**...............................100A @ TC=130°C/1200V
22. Power Diode **A90**...............................250A @ TC=135°C/1000V
23. Power Diode **6RW62**.............................200A @ TC=125°C/2000V
24. Controlled Avalanche Diodes (6 sizes).......0.5A to 250A, 500V to 1000V
25. Fast Recovery Diodes (4 sizes).......6A to 35A, 400V; t_{rr}=200 nsec Max.

. . . an SCR—but can I afford to put one in a light dimmer?" (*See No. 2 at left*)

. . . a thyristor designed for high frequencies—one that has low turn-off time." (*See No. 9*)

. . . a silicon rectifier that can handle 80,000 peak watts in the reverse direction." (*See No. 24*)

Spend a minute or two with the listings at the left, and you'll find that General Electric makes a silicon power semiconductor for almost any application you can think of.

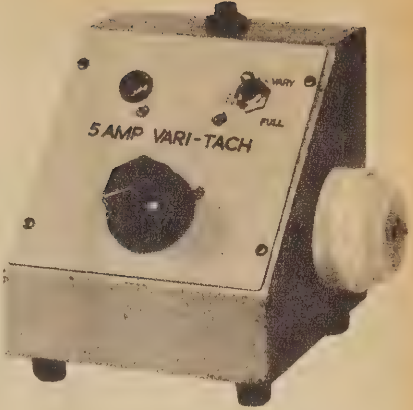
You'll find one for a cordless shaver, another for a motor-speed control, still others for mighty industrial equipment and military applications.

While you think of it, clip the list. Or better still, ask for General Electric's free "Reference Guide to Silicon Power Semiconductors." It lists twice as many types as we do here, with detailed descriptions and photographs as well. Contact your G.E. representative *Australian General Electric Pty. Ltd., 103 York St., Sydney, N.S.W. 29-7553; 522 Lonsdale St., Melbourne, VIC. 67-8221*

GENERAL ELECTRIC
Trademark

The "VARI-TACH" Motor Speed Control

Using this easily constructed and low-cost unit the speed of a "universal" or commutator-type AC motor may be adjusted over a wide range while still maintaining fairly constant torque. The unit is thus ideal for controlling the speed of electric drills and saws, food mixers, and movie projectors. It will handle up to 5 amps.



by Jamieson Rowe

In January, you may remember, we described the "Vari-watt" power controller: a unit which is ideal for dimming lamps and adjusting the heat of ovens and radiators. It uses the new "Triac" silicon gate-controlled AC switching device developed by General Electric.

While it is just fine for lamp dimming and heat control, the Vari-watt is not so well suited for the control of motor speed. Certainly it can adjust the speed, from maximum to virtual standstill, but with many motors this is not enough. Because the load on the motor varies widely, what is required is a controller able to **maintain** the selected speed under changing load conditions by automatically adjusting the power supplied.

This point was mentioned in the January article, and it was suggested that we might be able to describe a companion motor control unit if there proved to be sufficient reader interest. The almost immediate response to this suggestion is the reason for the appearance of the present article and its "Vari-tach" controller.

Perhaps before we go any further it should be stressed that the Vari-tach is in no sense an "improved" or "cheaper" version of the Vari-watt. The two units are not equivalent, but complementary: the Vari-watt is for lamp dimming and heat control, while the Vari-tach is for motor speed control. Although each may be capable of performing the other's function in some sort of fashion, performance under such conditions will tend to be rather disappointing.

The heart of the new Vari-tach unit is not the Triac, but its simpler and better-known relative, the thyristor or Silicon Controlled Rectifier (SCR). The operation of the thyristor was discussed in some detail in the January article, and will not be treated in detail here; however, the following brief explanation may be found worthwhile.

As shown in figure 1, the device has four silicon layers, of which three are connected to electrodes. The end P-type layer is termed the "anode" (A), the opposite end N-type layer the "cathode" (K), and the P-type layer adjacent to the cathode the "gate" (G).

When connected in series with a load and a suitably polarised source of current (V), junctions 1 and 3 are forward biased and offer a low resistance. But junction 2 is reverse biased, and prevents the flow of appreciable current. In this state the thyristor is virtually open-circuit or "off."

It can be made to conduct or switch "on" in a variety of ways, but the most usual way is to pass a small current through junction 3 via the gate electrode G. The effect of this current is to initiate an avalanche breakdown across junction 2 by injecting minority current carriers (electrons) into the gate layer from the cathode.

Once turned "on" in this fashion the thyristor remains in conduction until the anode voltage is dropped to zero, the gate electrode having virtually no further effect. The thyristor thus behaves very much like the thyratron valve.

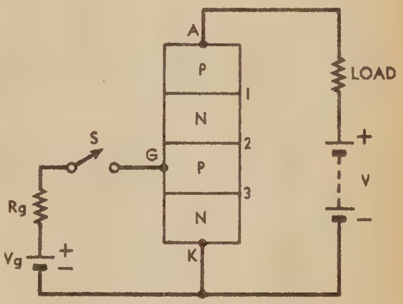
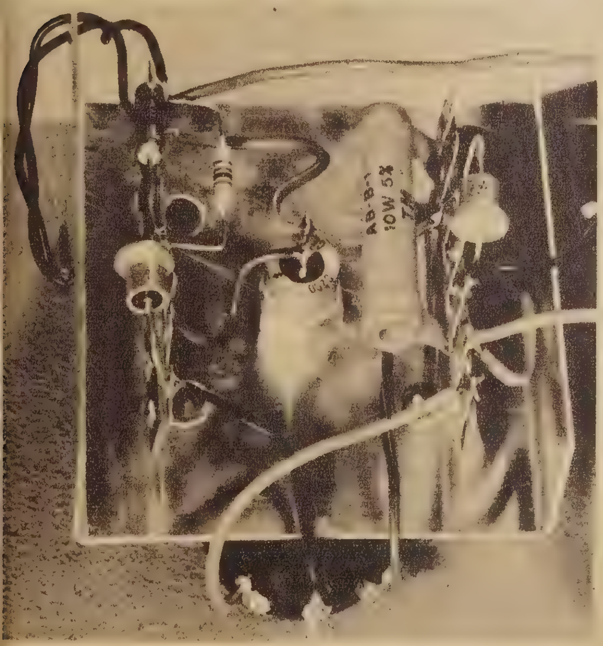


Figure 1: A diagram used to explain the operation of the thyristor or silicon controlled rectifier.

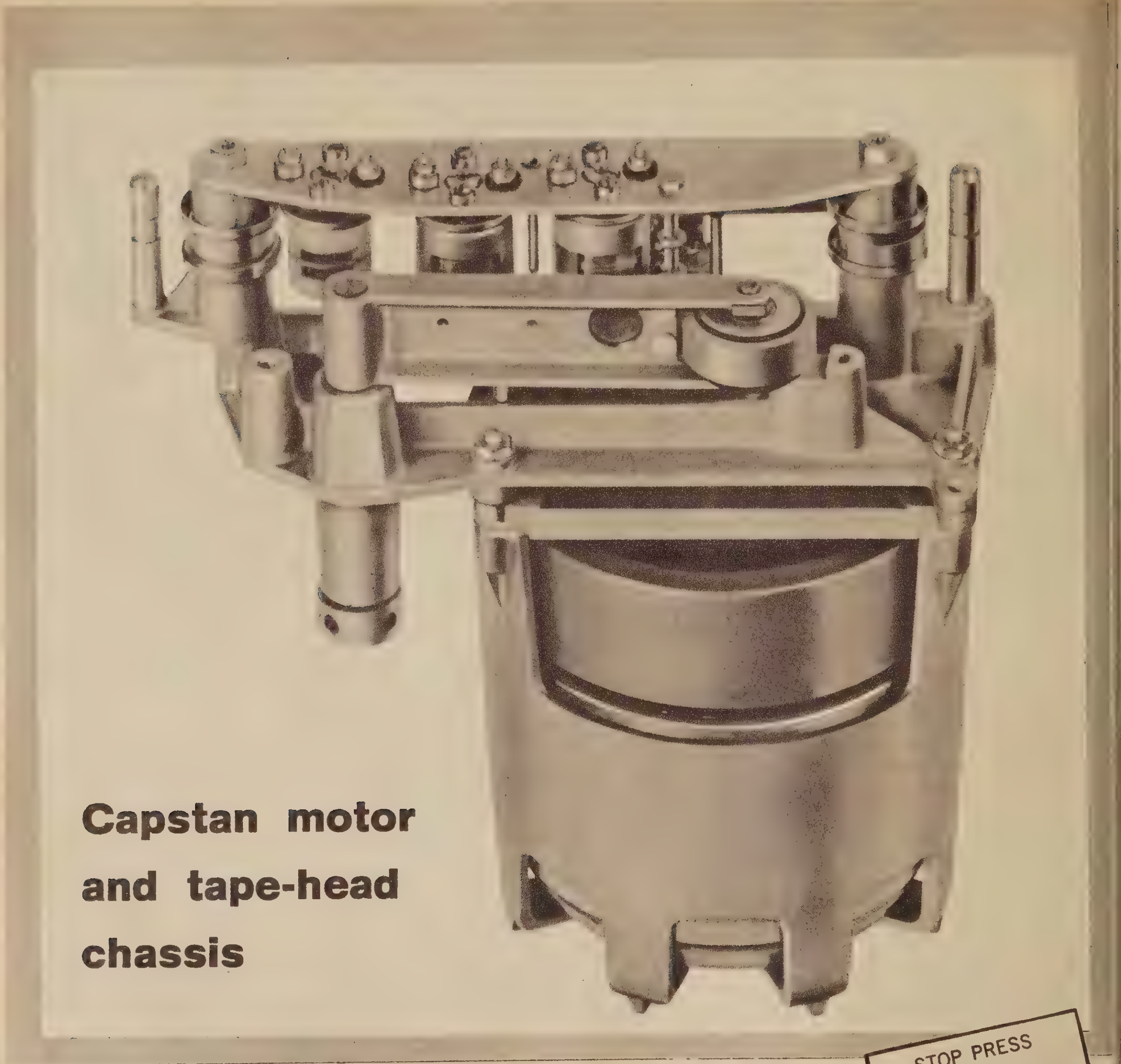
(There are special thyristors arranged so that the gate may also be used to stop conduction, but these "Gate Turnoff Switches" need not concern us here.)

Its self-latching behaviour makes the thyristor ideal for use in AC circuits where the supply voltage periodically falls to zero. While ever bias current is fed to the gate electrode, the thyristor will conduct current; yet when bias current is removed conduction will be maintained only until the end of the particular half-cycle in progress. Hence the suitability of the device as a controlled rectifier.

Whereas the Triac device used in the Vari-watt unit will conduct in both directions, and is thus ideal for full-wave AC control, its bi-directional behaviour makes it virtually useless for controlled rectification. And as will be explained shortly, the operation of the new Vari-tach unit depends upon the motor under control being supplied with controlled DC. Hence the choice of a thyristor rather than a Triac as the active device in the new unit.



On the rear of the panel an aluminium heat-sink supports the thyristor and most of the minor components. As the heat-sink becomes "live" it is insulated from the case.



Capstan motor and tape-head chassis

STOP PRESS

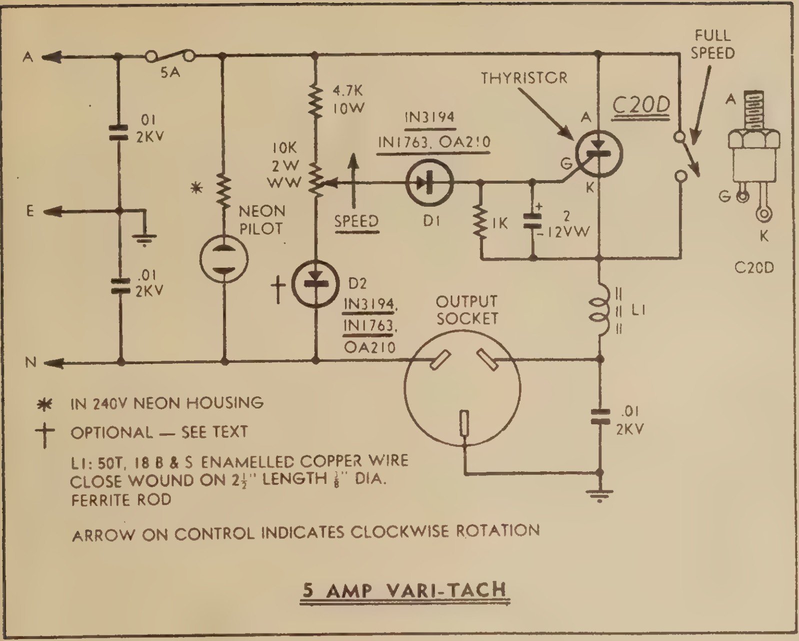
N.A.B. Spool centres are now available for the REVOX.

A design unique for an amateur recorder. Consisting of five diecastings, these parts, when attached to one another, form the very rigid unit which carries the head-block and tape-guides. This assures perfect and permanent head alignment under the roughest operating conditions. The powerful Hysteresis-Synchronous-Motor and the heavy accurately balanced flywheel are mounted in a diecast cage. The runout of the Capstan shaft must not exceed 0.001 mm. in order to pass inspection. This is a degree of accuracy found only in studio and broadcast equipments.

REVOX

HAVE
A LIFETIME'S
EXPERIENCE
IN
TAPE RECORDIN

SOLD AND SERVICED BY AMALGAMATED WIRELESS (AUSTRALASIA) LIMITE



5 AMP VARI-TACH

LIST OF PARTS

- *1 Small sloping-front metal case, 5in x 5in x 5in.*
- *1 G-E Thyristor, type C20D.*
- *2 Silicon diodes, type 1N3194, 1N1763, OA210 or similar.*
- *1 240V neon pilot assembly.*
- *1 5A cartridge fuse and holder.*
- *1 Single-pole 240V toggle switch.*
- *1 3-pin socket.*
- *1 1K half-watt resistor.*
- *1 4.7K 10-watt resistor.*
- *1 10K two-watt wire-wound pot.*
- *3 .01uF 2KV ceramic capacitors.*
- *1 2uF 12VW electrolytic.*
- *1 2½in length 3-8in ferrite rod, few feet 18G enamelled copper wire, plastic insulation tape.*
- *1 length mains flex and plug.*
- *4 1in fibre rods, tapped 1-8in Whit. each end.*
- *1 large instrument knob.*
- *Connecting wire, solder, etc. Scraps of 16G aluminium sheet, 5in x 3¼in and ½in x 1½in, to make heat-sink and cord clamp. Rubber grommet, 3-8in diameter; 3 x 7-lug tagstrips; screws and nuts, lockwashers.*

While complete full-wave DC control of motors is possible using thyristors, the new Vari-tach unit does not attempt to do this; it employs a single thyristor in a half-wave circuit. This approach has been found to give quite satisfactory operation with the great majority of commutator-type appliance motors, and has the considerable advantage of low cost; the simplest full-wave design would involve something like double the expenditure, and would doubtless have little appeal as a result.

The thyristor used in the Vari-tach circuit is a General Electric type C20D, a stud-mounting type physically identical to the SC40-D Triac used in the Vari-watt. The C20D has an RMS conduction current rating of 7.4 amps and a minimum forward breakover voltage of 400V. It requires a positive gate voltage of approximately 1V for triggering.

As the circuit shows, the thyristor is wired in series with the output socket, with the latter in the thyristor's cathode circuit. Inductor L1 and the three .01uF capacitors are for interference suppression, and may be ignored for the present.

Triggering voltage for the thyristor is provided by the 10K potentiometer. During each positive half-cycle (referring to the anode polarity), the pot provides a sinusoidal triggering voltage with an amplitude variable from close to zero to approximately 160V RMS. This is applied to the gate electrode via diode D1, whose purpose is to protect the gate during the unused negative half-cycles.

The potentiometer voltage thus supplied is **not** the total effective thyristor triggering voltage, because the load is connected in series with the thyristor cathode. In other words the load voltage contributes to the triggering voltage: there is negative feedback. It is this mechanism which allows the Vari-tach to maintain a selected motor speed despite load variations.

To visualise how the feedback works, consider what happens when power is first applied with the pot set to mid-range. Since the motor is stationary, it will have a very low resistance, and a correspondingly low voltage drop.

Under these conditions the pot voltage will be the full triggering voltage applied to the thyristor, and the latter will fire very early in each positive half-cycle. This will feed large pulses of power to the motor, and the latter will rapidly accelerate.

As the motor gathers speed, its armature back-EMF will rise proportionally. It should be noted in this connection that there will actually be TWO different back-EMFs: one present during the negative half-cycles and the early part of the positive half-cycles, when the thyristor is not conducting, and the other present during the conduction periods of the thyristor. It is the former with which we shall be concerned, as it is only this "non-conduction back-EMF" which contributes to the triggering of the thyristor.

The "non-conducting back-EMF" is generated by the armature of the motor because the field iron retains a small remanent magnetism from the preceding conduction period. Hence the reason why this control technique requires the motor to be fed with unidirectional or DC current pulses: to ensure that the remanence in the motor and the resultant speed-proportional "non-conducting back-EMF" have the correct polarity.

The motor back-EMF has a polarity such that it tends to make the thyristor cathode positive with respect to the gate, opposing the potentiometer voltage; or putting it another way, the back-EMF subtracts from the potentiometer voltage to produce a lower effective triggering voltage. Thus as the motor gathers speed and its back-EMF rises, the thyristor trigger voltage is gradually reduced.

This has the effect of retarding the thyristor conduction point to a point later in each positive half-cycle, supplying less energy to the motor.

Because of this feedback the motor speed ceases to rise when the triggering voltage has fallen to a level where the thyristor is only just supplying sufficient power to the motor to maintain the speed. An equilibrium is reached, with the motor running at a constant speed

ACOS REPLACEMENT CRYSTAL CARTRIDGES

GP67-1G. A high-quality monaural turnover cartridge with an extended frequency response and excellent tracking capabilities. A standard replacement crystal cartridge for most players and changers. Replaces HGP37 and GP65 series. Standard ½" mounting bracket. Price: £2/18/6.

**HGP39. Crystal cartridge. Available for standard or L.P. recordings for use with HGP20 and HGP40 Pick-up Arms.
Price Single Sapphire Stylus, £3/12/6.
Single Diamond Stylus, £5/13/6.**

Sole Australian Agents:

AMPLION (A'SIA) PTY. LTD. 29 Majors Bay Rd., Concord, Sydney, N.S.W. Phone 73 1227

Victorian Distributors:
E. W. Cornelius Pty. Ltd., 5 Northumberland Street, South Melbourne, VICTORIA

PRECISION ELECTROACOUSTIC EQUIPMENT

TRUMPETS

HD. 210/P

Low frequency cut-off	350 Hz
Sound distribution	120 deg
Air column length	350 mms
Power rating	6 watts
Watts peak	15 watts
Impedance	16 ohms
Frequency response	350 ÷ 10000 Hz
Maximum diameter	210 mms.
Maximum length	210 mms.
Weight	1,300 grs.

Price Retail £12-16-0
Plus Sales Tax £1-6-8

H. 300

Low frequency cut-off	220 Hz
Sound distribution	90 deg.
Air column length	550 mms.
Maximum diameter	315 mms.
Maximum length	365 mms.
Weight	1,500 kgs.
Power rating	18 watts
Watts peak	35 watts
Voice coil impedance	16 ohms
Frequency response	120-7,000 Hz
Maximum diameter	82 mms.
Maximum height	68 mms.
Weight	1020 grs.

Complete with accessories for application for line transformer.

Price Retail £19-5-0
Plus Sales Tax £2-8-1

H. 450/5

Low frequency cut-off	150 Hz
Sound distribution	85 deg.
Air Column length	915 mms.
Maximum diameter	445 mms.
Maximum length	540 mms.
Weight	4 kgs.

It may be supplied also without cover-hood for fitting the driver unit model 2545 TS.

Power rating	25 watts
Watts peak	45 watts
Voice coil impedance	16 ohms
Built-in line matching transformer:	16—165—250—500—1000 2000—3000 ohms
Frequency response	80-12,000 Hz
Watertight construction	
Equalised compression system	
Maximum diameter	110 mms.
Maximum height	150 mms.
Weight	2180 grs.

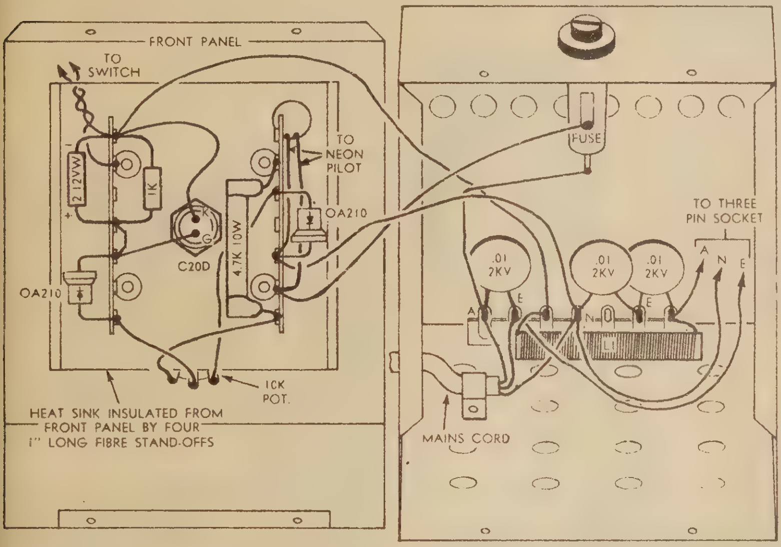
Price Retail £37-1-0
Plus Sales Tax £4-12-8

ZEPHYR PRODUCTS PTY. LTD.
58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA
MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

determined by the setting of the 10K pot.

If the load on the motor increases, tending to slow it down, its back-EMF will fall. This will increase the effective thyristor triggering voltage, and the thyristor will conduct earlier in each positive half-cycle. The motor will thus receive more power to help maintain its speed.

Conversely, if the motor load is reduced, it will tend to speed up. However this will increase the back-EMF, and reduce the effective triggering voltage. The thyristor will thus deliver less power to the motor, keeping its speed at the set level.



Using this wiring diagram together with the photographs and circuit it should be an easy task to copy the original unit. Don't forget to ensure that the metal case is connected to the earth lead.

With most commutator-type AC motors as used in electric drills, food mixers, and movie projectors this circuit will give quite good regulation over a fairly wide speed range. Only in rare cases will the regulation be poor, most such cases being where the motor iron is of a type which has a very low remanence. Such cases must be regarded as unfortunate, as considerably more elaborate circuitry would be required to give adequate regulation.

Heart of the unit is the C20D thyristor, shown here a little larger than actual size.

It will be found that there tends to be a small amount of "cogging" or jerkiness at very low speeds. This is mainly due to false triggering produced by commutator hash. The 1K resistor and 2uF capacitor connected between gate and cathode of the thyristor serve to keep this to a minimum, acting as a hash bypass.

As the circuit operates only on alternate half-cycles of the AC mains, full-speed and power are not available via the control circuit. (Although it should be noted that the power and speed will be somewhat **more than half** the rated figures with most motors, due to remanence effects.) To provide full power and speed when required, we have provided a switch which shorts out the thyristor.

Diode D2 tends to give smoother running at low speeds, particularly with highly geared drills. Presumably it does this by preventing the flow of inductive motor back-EMF components through the thyristor gate-cathode circuit. It is marked as optional because with many motors its omission will result in no obvious change in performance.

The circuit is provided with a neon pilot lamp and a 5A protective fuse. This fuse rating will permit the unit to be used with almost any power tool or appliance fitted with a commutator-type motor, yet will break the circuit rapidly in the event of a serious overload. Fuses of higher current capacity should not be used.

As with the Triac device used in the Vari-watt, the thyristor tends to generate RF interference because of its extremely rapid switch-on. However the series inductor L1 and the three .01uF capacitors slow down current changes and suppress transients, keeping the interference to a very low level.

The construction of the Vari-tach is very similar to that of the Vari-watt. It is housed in the same small 5in x 5in x 5in sloping-front instrument case, with the mains cord entry at one end and the output socket at the other. The fuseholder is at the top, with the control knob, pilot and "full speed" switch on the sloping panel. Ventilation holes in the base and rear of the case provide for convection cooling, while four small rubber feet complete the unit.

The interior of the case is again very similar to that of the Vari-watt. With the exception of the interference suppression components which are supported on a tagstrip at the lower rear of the case, the minor components are supported by tag strips mounted on an in-

Electronics Australia D.S.B. Transmitter Featured in November 1965 Issue

GELOSO PARTS SPECIFIED

4/105 VFO	$25.00
N.1657 Dial	$ 5.60
4/113 Pi coupler	$ 4.30
N/771 Condensor	$4.00
N/774 Condensor	$4.00
N/17634 RF choke	$0.88

Plus 12½% Sales Tax

ALL AVAILABLE FROM RADIO WHOLESALERS OR

AUSTRALIAN AGENTS

R.H. Cunningham PTY. LTD.

8 Bromham Pl.
Richmond Vic.
42-1614

64 Alfred St.,
Milsons Point.
929-8066

G. E. (U.S.A.)
SEMICONDUCTORS

For projects featured by 'Electronics Australia'

DIAC-ST2	$2.85
TRIAC-SC40D	$7.80
UJT-2N2160	$1.90
UJT-2N2646	$1.35
SCR-C20D	$3.80

All plus 12½ p.c. Sales Tax.

AVAILABLE THROUGH RADIO SUPPLY STORES IN ALL STATES.

WATKIN WYNNE PTY. LIMITED
32 Falcon St., Crow's Nest
(P.O. Box 318). Phones: 43-2107, 43-1912

TRANSISTOR SERVICE
ALL JAPANESE MAKES
REPAIRED
including . . .

Aristone
Berlin
General
Mariner
National
Sony
Sharp

Aurora
Crown
Hitachi
Mitsubishi
Nivico
Spica
Toshiba

Belair
Fujiya
Kenco
Nanaola
Sanyo
Standard
Yashica

We do not sell spare parts

PETER G. BROUGHTON
211 George Street
Sydney Tel. 27-5831

ARE YOU THINKING OF
STEREO SYSTEMS or COMPONENTS?

Then before you buy call into
MASTERSOUND "SOUND CELLAR"
SYDNEYS FINEST LISTENING CENTRE

and hear some of the World best sound equipment in operation.
Make your choice from our wide range of Turntables, Cartridges, Amplifiers, Tape Decks, Loud Speakers, and Pick-up arms. We can offer you outstanding Service unsurpassed in Sydney, including initial Planning and advice, Demonstration, matching and balancing of equipment. Finance, long warranty's, excellent after Sales Service.

We are now proud to introduce to our already wide-range of HI-FI equipment, a new concept in Stereo Tape Recorders.

AMPEX
2000 SERIES
STEREOPHONIC TAPE RECORDER/PLAYER

AMPEX
THE NEW STATUS OF STEREO
If you are upgrading your present stereo system, or going to tape for the first time the Ampex 2000 will deliver more performance and more features than any other tape recorder on the market. It is a medium priced recorder and an investment in years of fine music and enjoyment.

FEATURES
Loads automatically. Reverses automatically. 3 speed operation. Plays in both directions. Split level Record meters. Interlocked Tape Controls. Ease of operation, etc.

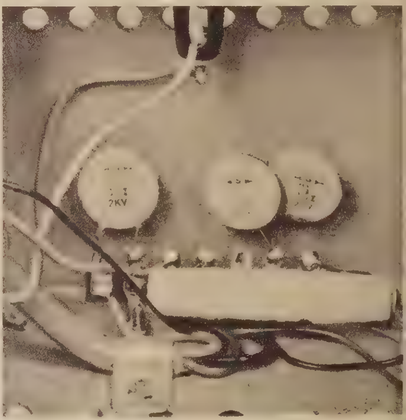
MASTERSOUND
SALES PTY. LIMITED
LIDO HOUSE, 400 KENT STREET, SYDNEY. 'PHONE 29-1527

sulated aluminium bracket which forms the thyristor heat-sink.

The bracket is bent up from a 5in x 3½in scrap of 16G sheet, bent into a "U" shape 3in x 1in x 3½in. The thyristor mounts via its stud in a ¼in hole in the centre of the bracket. Note that the hole should be a tight fit for the thyristor stud, to provide efficient thermal contact.

The bracket must be insulated from the earthed case because it becomes "live" when the unit is in operation. The insulated mounting is made via four 1in x 3/8in diameter fibre rods, tapped 1/8in Whitworth at each end. Four countersunk-head screws fasten the rods to the front panel, while the screws which fasten the bracket to the rods also support the two tagstrips. A hole in the bracket clears the insulated leads from the neon pilot.

The C20D thyristor may be ordered via local parts suppliers from Watkin Wynne Pty. Ltd,, of 32 Falcon Street, Crow's Nest, N.S.W. The cost of this component will be approximately $3.80 (£1/18/) plus tax. As this is the major component, the complete project should cost no more than about $12 (£6).



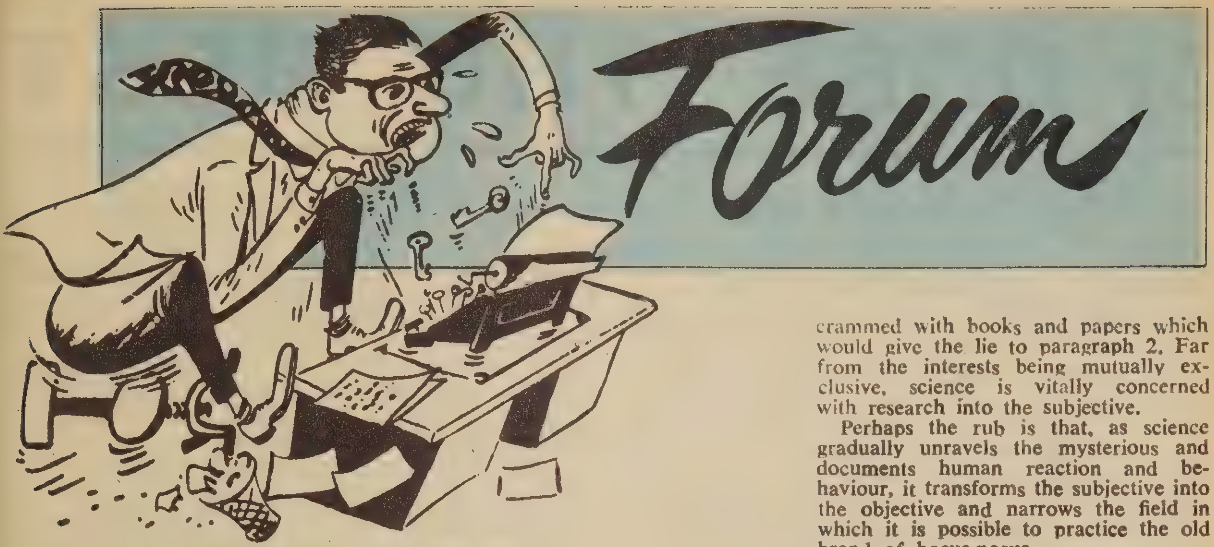
A view of the inside rear of the case, showing the interference suppression components and the mains cord entry. Note the small clamp used to anchor the mains cord, and also the ventilation holes.

The mains cord is clamped to the base of the case with a small aluminium clamp to prevent strain on the soldered joints. The ventilation holes in the base and upper rear of the case are ¼in diameter, to allow cooling yet ensure safety.

The interference suppressor inductor is identical with that used in the Variwatt. It consists of 50 turns of 18 B and S enamelled copper wire wound on a 2½in length of 3/8in ferrite aerial rod, with layers of plastic insulating tape above and below the close-wound wire layer.

Using photographs, circuit and wiring diagram as a guide it should be a simple matter to wire up the project. Before connecting the completed unit to the mains it is a wise move to check the heat-sink insulation with a continuity tester; there should be no connection between heat-sink and case.

When completed, the Vari-tach should be ready for immediate use. It should quickly repay its modest cost in terms of convenient low-speed operation of drills, food mixers, movie projectors and similar appliances. ■



THOSE "ELECTRO-MEDICAL" GADGETS

More or less as I expected, the subject of "Get well—Electrically", raised in the November issue and referred to again last month, has not rested there. Our correspondent J. A. has invoked moral support from some of his technical acquaintances at the Woomera Rocket Range and also from a well known magazine editor.

By W. N. Williams

"Dear Mr Williams,

"Further to my previous letter on the subject of electronic gimmicks, I have written, as I threatened to, to one who knows much more about these things than either of us. His reply is enclosed and is self-explanatory.

"If you do not know of it, 'Analog' is the most respected magazine in the field and Mr Campbell probably the best-known editor of science fiction in the world. While I do not claim his to be a definitive opinion, perhaps it may make you rethink your previous statement.

"Your article has caused quite a deal of discussion among some of our Range personnel. I expect to see several of the disputed gadgets joining the ranks of divining rods, ionisers and other dinguses built and tested (with varying success) by respected members of the organisation.

"Would you care to know the results or are we all electronic quacks?

"Yours in anticipation, J.A."

The letter from Mr Campbell is set out on the following page. I have had no personal dealings with Mr Campbell and he may be well qualified to write on the subject but I find it vaguely amusing to have one such qualification tied to his role as a science fiction editor.

However, I suggest that you read the letter for yourself, at this juncture, and see whether or not you find it convincing.

As for myself, far from causing me to re-think my previous statements, the letter has rather confirmed my convictions that they were completely appropriate.

The first paragraph in the letter makes claim that the gadgets "work" — for some people, I presume.

I readily concede that certain people may quite genuinely testify to an effect from a certain gadget—perhaps a very beneficial effect, like sleeping more soundly at night.

But, on a purely psychological basis, there is a high order of probability that some people would react in this very way and such reaction can be studied as far as our present understanding of psychology will allow. There is no reason at all to believe that the gadget itself has any direct clinical merit, other than being the focus of auto-suggestion.

The statement that the gadget works just as well in circuit diagram form, to me proves the validity of this view. I don't see how it can possibly prove any merit in the gadget itself, because electrically and mechanically the drawing and gadget have nothing in common.

The next par begins "Science has never studied the nature of subjective reality . . ."

Surely you're not being serious, Mr Campbell.

A very large proportion of modern scientific research is concerned directly with evaluating subjective reaction.

To start on home territory, what about all the research that has been conducted to establish references in relation to sonic phenomena — thresholds of pain and perception, annoyance, pitch, harmony, comparative loudness, fidelity and so on?

What about the mass of research into the subjective effects of medicines and treatments, and the elaborate precautions that are taken with control groups to isolate the basic clinical effects from sheer "imaginitis"?

What about all the research into behaviour patterns?

And thought processes — with the vague but nonetheless evident links back to computer technology?

In fact, the libraries of the world are crammed with books and papers which would give the lie to paragraph 2. Far from the interests being mutually exclusive, science is vitally concerned with research into the subjective.

Perhaps the rub is that, as science gradually unravels the mysterious and documents human reaction and behaviour, it transforms the subjective into the objective and narrows the field in which it is possible to practice the old brand of hocus-pocus.

The rest of the letter is a mixture of illustration and synonym which adds up to a lot of words but not a great deal of logic.

It is true that only a limited number of people can play the violin successfully but this does not prove that a similar can-and-can't situation will necessarily apply to other entirely different activities.

It might be relevant to observe, however, that I can't play the violin myself; but when I watch and hear someone who can, I am not left in any doubts as to their ability.

And then that paragraph near the end, about the Aborigines. It reads like a very eloquent and damning statement about the attitude of scientists in general.

There's just one thing wrong with it:

Most of the conventionally educated people I have ever spoken to are well aware of native traditions, witchcraft, cures, spells and so on. Far from stating very positively that certain things can't possibly exist, they are inclined to study them very closely.

But one thing I will say — and this mightn't be a bad note on which to finish:

When a scientist sees a native die, the victim of a bone-pointing ceremony, he doesn't become pre-occupied with the bone. He is more logically concerned with the mental and physiological processes of the victim, and possibly the avenger, leaving open the question of mental telepathy.

I venture to suggest that our correspondents, and people who think as they do, may be well advised to get away from these electronic "bones" and concern themselves with fundamental cause and effect.

Significantly, to acquire and use formal training requires a great deal of mental effort and discipline. And lack of such training is probably the basic reason why some people at least seek to translate things into the realm of the mysterious; there they can evade formal measure and take ultimate refuge, if necessary, in the role of a mental martyr.

No thank you, J.A. and Mr Campbell—you can keep your improbable gadgets.

From a reader in Western Australia comes a letter commenting on the edi-

CHOOSE THE BEST

A LOUDSPEAKER UNIT

GOODMANS FULL RANGE SINGLE UNIT HIGH FIDELITY LOUDSPEAKERS

AXIETTE 8 (8 inch – 6 watt – 15 ohm)
The smallest full range High Fidelity loudspeaker unit produced. **Price: $24.60 (£12/6/-)**

AXIOM 10 (10 inch – 10 watt – 15 ohm)
The very popular and economical "medium size" High Fidelity loudspeaker. **Price: $30.20 (£15/2/-)**

AXIOM 80 (9½ inch – 6 watt – 15 ohm)
The hand-built twin cone transducer featuring exclusive "free edged" suspension giving very high quality sound reproduction for the connoisseur. **Price: $77.60 (£38/16/-)**

AXIOM 201 (12 inch – 15 watt – 15 ohm)
The remarkable 12" twin-cone High Fidelity Speaker for the enthusiast who does not require the higher power handling of the Axiom 301. **Price: $53.60 (£26/16/-)**

AXIOM 301 (12 inch – 20 watt – 15 ohm)
The world's most advanced 12" High Fidelity twin cone loudspeaker. **Price: $77.25 (£38/12/6)**

TRIAXIOM 1220c (12 inch – 20 watt – 15 ohm)
Triple element 12" loudspeaker, spanning over 9 octaves giving professional standard High Fidelity. Complete with adjustable Treble control. **Price: $95.80 (£47/18/-)**

–BUILD UP A SYSTEM

GOODMANS MULTIPLE SPEAKER HIGH FIDELITY SYSTEMS

consist of an Audiom Bass unit and pressure-driven horn-loaded mid-range and high frequency units, with crossover networks and attenuators. The result–very low distortion, high sensitivity 3-way loudspeaker systems.

BASS UNITS

(12 inch - 15 watt – 15 ohm) **AUDIOM 51 BASS**
Rugged 12" single diaphragm speaker, specially designed as Bass unit in a 3 way system. **Price: $45.30 (£22/13/-)**

(12 inch - 20 watt - 15 ohm) **AUDIOM 61 BASS**
Powerful, extra high efficiency 12" unit, giving exceptional performance and control—ideal as Bass unit in 3 way systems. **Price: $72.60 (£36/6/-)**

(15 inch – 25 watt – 15 ohm) **AUDIOM 81 BASS**
Capable of handling high power with very low distortion. Ideal in high powered 3 way High Fidelity systems. **Price: $127.80**

(18 inch – 50 watt – 15 ohm) **AUDIOM 91 BASS**
Exceptionally robust, heavy duty 18" loudspeaker for very high power systems. **Price: $161.00 (£80/10/-)**

N.B. Multiple Speaker Systems can also be "stage-built" using Axiom 201 or 301 as the first stage unit. Full details in the High Fidelity Manual.

Standard Versions of all Audiom speakers are available for Public Address work and Musical Instrument amplification (Electric guitars etc.)

CHOOSE GOODMANS

A COMPLETE SYSTEM IN MINIATURE

GOODMANS MAXIM

Only 10½" x 5½" x 7¼" deep. Fantastic! but true—the smallest *true* High Fidelity loudspeaker system made. No bigger than a stout book, but with a really outstanding performance. Up to 8 watts of power.

Price: $89.00 (£44/10/-)

COMPONENTS FOR MULTIPLE SPEAKER HIGH FIDELITY SYSTEMS

TREBAX HIGH FREQUENCY PRESSURE UNITS

TREBAX 100 Range 2,500-20,000 c/s, covering the treble register smoothly with very low distortion. Crossover frequency: 5,000 c s. System power handling: 25 watts. **Price: $28.00 (£14/-/-)**

TREBAX 5K/20XL As Trebax 100 but handling 20 watts of power in systems. Complete with built-in crossover network and attenuator. **Price: $34.10 (£17/1/-)**

MIDAX MID-RANGE PRESSURE DRIVEN HORN UNIT

Range 650-8,000 c s, covers the middle register with high efficiency and realism. Crossover frequencies: 950 and 5,000 c s. System power handling: 25 watts. **Price: $48.20 (£24/2/-)**

CROSSOVER NETWORKS

XO/950/5000 Crossover frequencies 950 and 5,000 c s. For use with Audiom Bass unit, Midax and Trebax 100. **Price: $33.50**

XO/950 Crossover frequency: 950 c s. For use when adding Midax to Axiom and Trebax. **Price: $28.65 (£14/6/6)**

XO/5000 Crossover frequency: 5,000 c s. For use when adding Trebax 100 to **Axiom** unit. **Price: $10.65 (£5/6/6)**

ATTENUATOR

For use with Trebax 100 and Midax. 8-step, 0db-12db and "off". **Price: $13.10 (£6/11/-)**

STILL UNDECIDED? Call at your Goodmans Dealer for a demonstration or send for Goodmans High Fidelity Manual, giving full specifications and information.

Made in England by Goodmans Industries Ltd.

Sole Australian Agent:

BRITISH MERCHANDISING PTY. LTD.

60 Clarence St., Sydney, N.S.W. Telephone 29.1571

FREE Please send me details of Goodmans loudspeakers listed below.

Models required..

....

Name..

Address..

....State........................

torial in the January issue. I quote the letter in full:

> *Dear Sir,*
>
> *May I be permitted some little space in your periodical to express my appreciation of your leader article (January, 1966) and to add a few comments of my own?*
>
> *Several times recently I have had letters published in one of our local newspapers concerning the lack of balance between musical programs broadcast in this State.*
>
> *We have six stations in all, four commercial and two A.B.C. networks (6KY, 6IX, 6PM, 6PR and the A.B.C. stations 6WN and 6WF). The four commercials "dish out," simultaneously and almost continuously, so-called "pop" music to the almost complete exclusion of anything of a more worthwhile nature.*
>
> *6WN provides fine fare, but often the musical works broadcast are too heavy for average tastes. 6WF, when not handling sports, is often devoted to Parliament and, if there is any time left, goes over in the afternoons to "pop" request items and suchlike.*
>
> *The above represents a fairly accurate picture of the present state of affairs—a state which is both fantastic and deplorable and which is viewed with grave concern.*
>
> *In company with many others, I strongly resent having my listening pleasure cut short by the overwhelming preponderance of musical rubbish and station dictatorship.*
>
> *It is not morally right that I should have to use my personal record collection as a forced alternative to local music broadcasts. My radio licence fee is just as valid as is that of the teenager, but my musical requirements are not catered for in proportion.*
>
> *I understand that TV programs here are also on the downgrade.*
>
> *Surely there is something that can be done to improve matters generally?*
>
> *M. McM. (Cottesloe, W.A.)*

Well, not having any first-hand knowledge of the situation in Western Australia, I must accept our correspondent's statements on face value. This is not difficult, however, as it would appear very largely to mirror the position in the eastern States.

As far as the commercial radio stations are concerned, their operation must be linked to the task of staying in business and if the teenager, with his transistor set is their major audience—or apparent audience—one can hardly wonder at them leaning that way.

In fact, a close examination of their programs may reveal that a good deal of non-beat music is included but needing to be located by a systematic study of their schedules. Since people are not inclined to do this, they tend to switch on the radio at random, hear a cacophony of sound they don't like, and assume that all the stations are like that all the time.

Once this image is established, people tend not to bother any more, turning to other forms of entertainment.

The A.B.C. stations are in a somewhat different positon since they are not directly dependent on income earned. They are sensitive, however, to audience reaction and ratings.

It is usual, and perhaps understandable, to attack the Australian Broadcasting Commission for radiating programs which are not to one's liking. It is not always realised that the A.B.C. have to do the best they can with what they have.

"THEY DO WORK . . ."

Dear Mr A.

That trick electronic circuit looks quite standard to me. I've seen dozens of them. I can tell you some of their properties, and not the least interesting facts are: (1) they do work; (2) they work just as well with dead batteries; and (3) they won't work if you leave out the battery. But (4) the circuit diagram alone, if complete with battery-symbol, will work just as well.

Science has never studied the nature of subjective reality, because it simply holds that "subjective" and "reality" are mutually exclusive terms. Therefore, w know nothing whatever about the effects and forces involvea at the subjective level.

These devices are subjective devices, not objective. They work by reason of real but unstudied-by-science subjective forces. They're unreliable, just as creative thinking is. (Even the greatest genius has his off days, and can't guarantee to do any assigned task at an assigned moment. But that doesn't prove he isn't a great creative thinker.)

Part of the problem is that devices of this type—including dowsing rods!—work for some individuals and not for others. (Of course, the same is true of violins, for that matter. Some people don't have the sense of pitch necessary and simply cannot learn to play a violin, no matter how long they practise.) We don't know how to build the right kind of "framismeter" to measure which individuals have sufficient "framis output," so it appears the devices operate purely at random.

Since they are subjective, not objective, devices, what they are made of, or how, is of no importance whatever. The letters "lion" are a symbol for a sound; the sound in turn is a symbol for an animal. Symbology is a subjective study—much of subjectivity is tightly coupled with symbology. (Ask any psychologist!) Now, does it make any difference whether those letters "lion" are cast in concrete and stand twenty feet high or scratched in sand with a stick, or done by impressing an ink-coated ribbon against paper with small shaped metal keys?

That's why these subjective devices work just as well when they're circuit diagrams as when they're made with objects like resistors and batteries.

But until some honest work is done studying the nature of subjective reality, the objective-oriented scientist isn't going to acknowledge that there is any rationality whatever to these phenomena, and will therefore deny that they exist.

Try talking with some people who've lived among your local Aborigines; they'll tell you that they have some exceedingly effective and useful techniques that science will state very positively can't possibly exist!

Telepathy, for instance, is standard operating procedure among them for passing along important news.

Sincerely yours,
John W. Campbell,
Editor, "Analog."

Before publishing the editorial in the January issue, I discussed the matter of program content with a representative of the Commission in Sydney. It was obvious that he was not very happy with the situation.

He pointed out that, while the A.B.C. stations are subdivided into three networks, there are only two effective channels in each area. The Federal Government demands a large slice of time for the broadcast of its proceedings, while another large section of the community demands a cricket and other

For the first time in Australia

A distinctive and revolutionary

OKI range of **TAPE RECORDERS**

will shortly be released

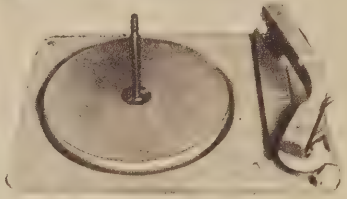
MODEL 555 — STEREO — $375 Plus Mikes.
MODEL 333 — STEREO — $350 Complete.
MODEL 300 — STEREO — $275 Complete.
MODEL 222 — 4 TRACK MONO — $225 Complete.
MODEL 111 — 2 TRACK MONO — $165 Complete.
MODEL 300D — STEREO DECK — $225 Plus Mikes.

Imported and distributed by:

RALMAR AGENCIES PTY. LTD.
89 YORK STREET, SYDNEY—PHONE: 29-4037.

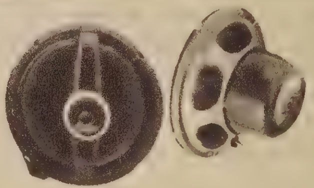
COMPLETE STEREO SYSTEMS BASED ON THE

SUPERB STAR SA30

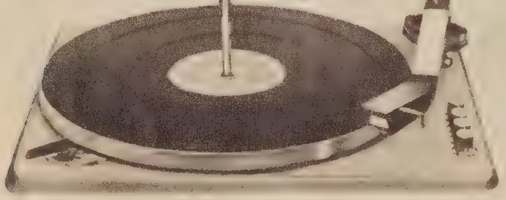

ELAC 16
PLAYER/CHANGER

PEERLESS
120-20-20
CO-AXIAL
SPEAKERS

PEERLESS 0825 FM
SPEAKERS


PEERLESS 825-20
CO-AXIAL
SPEAKERS

ELAC 10 H
PUSH-BUTTON CHANGER



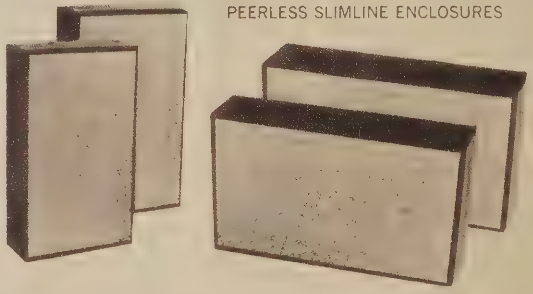
CHOICE OF STEREO CARTRIDGES

ELAC 322

ELAC 222 D

MAGNECORD
SC 202

PEERLESS SLIMLINE ENCLOSURES



MATCHED COMPONENTS

Star SA 30 Stereo Amplifier • Elac No. 16 Player/Changer • Peerless twin cone or co-axial speakers in selected enclosures.

TRADE-INS . . . EXTENDED TERMS TO APPROVED CLIENTS

£150 $300

STAR PEERLESS MATCHED SYSTEMS

ITEM	PRICE	ITEM	PRICE
Elac 16	£20 8 3	Star SA 30	£55 18 0
Elac 10 H	72 0 0	2 x 1 c.f. Encl.	28 17 6
Elac 40	60 0 0	2 x 1.7 c.f. Encl.	32 5 0
16 Teak Base	5 3 0	2 x 3.5 c.f. Encl.	61 1 0
16 Plexiglass Cover	5 18 0	2 x Peerless 0825 FM	10 3 0
10 H Teak Base	7 0 0	2 x Peerless 825-20	27 4 0
10 H Plexiglass Cover	7 18 0	2 x Peerless 120-50	30 2 0
		2 x Peerless 120-20-20	39 9 0

THE SMART WAY TO BUY HI-FI!

Take the superb STAR SA 30, established, recognised and proved over many years.

Add to it your choice of Denmark's famous Peerless range of loudspeakers (twin cone or co-axial) and whichever Elac player your pocket can afford.

And remember that Elac is the ONLY player which can also be used as a push-button automatic changer WITHOUT crystal or magnetic cartridge modification.

This gives you the best selling amplifier from Japan (known in U.S.A. as The Lafayette) and the largest selling speaker from Denmark, PLUS the famous German Elac player/changer.
You can buy it four ways—four different prices!

First see your regular hi-fi dealer. If he cannot supply, do not hesitate to contact the importers at

CHAPMAN HOUSE, 210 CLARENCE STREET, SYDNEY • PHONE 291704

X838

sporting service. By the time these two demands are met, the programmers virtually have one channel left on which to meet the varied demands of listeners wanting music at all levels, talks at all levels and drama.

From a programmer's point of view, the position is quite impossible.

What's your answer to this dilemma? Demand that the Federal Government cease broadcasting, to begin with? Demand extra channels for the Commission on the present medium wave band, costs notwithstanding? Demand a completely new class of service on F.M. again on the basis of cost what it might?

At this point, I should perhaps acknowledge a batch of letters which were prompted by the January editorial and which came to hand after I had written the foregoing in reply to M.McM. In fact, the two earlier pages were already standing in type by the time they arrived.

The following are typical of the letters received and the sentiments expressed by the writers:

R.B., of New Lambton, N.S.W., says that the reason why he—and presumably many others—failed to protest at the cessation of AM-stereo broadcasting was that they had been "effectively silenced by the absolute self-centredness of the A.B.C." Writing a letter seemed like so much waste of time, as it was in the case of the FM broadcasts.

W.F. (Zillmere, Qld.) and G.B., Box Hill, Vic.) are among others who feel that protests count for nothing.

(As we have already pointed out, the A.B.C. can only do its best with the facilities which it is granted. The FM channel was appropriated for other purposes by Parliamentary decision, which many in the A.B.C. didn't like at all.)

G.R. (Brisbane, Qld) suggests that the half-baked stereo system using two AM transmitters could never gain public acceptance, particularly in areas where noise is a problem. But he believes that lack of support for this system cannot be taken as an indication of the public's potential lack of interest in a modern FM-Stereo service. He does emphasise, however, that a new service would need to be carefully planned and properly publicised.

"Listener" from North Sydney also says that he could derive little pleasure from the "limited fi" available from his two AM tuners and was therefore not unduly perturbed by the cessation of the transmission. He seeks assurance that an FM-stereo system of broadcasting would be a lot better.

(It could be and it should be, "Listener.")

R.R. (Brighton, Vic.) is another who stresses the inadequancy of the double AM system, but mentions the lateness of the hour, the limited program time and the impossibility of pleasing everybody with a single program, as reasons why the stereo broadcasts failed to attract a following.

He expresses the hope that this will not be taken as evidence against the introduction of a proper system because he regards broadcast programs, particularly from the A.B.C., as an important part of his entertainment.

Expressing the opposite view, R.D., of Bayswater, Victoria, says that he has an adequate stock of stereo recordings to provide him with all the music he wants in the home and he is preparing to fit his car with a tape system. As far as he is concerned, FM stereo is quite unnecessary and he would much rather see industry resources directed towards providing a good colour television service, preferably of higher technical standard than is currently displayed by present-day "blue and white" receivers.

With an eye to the practical, I.H., of Manly, N.S.W., would like us to publish an article on the cost of a UHF FM receiver and the range of transmissions.

(If we did, both would be heavily loaded with speculation. The effective range of broadcast services on UHF is the subject of optimistic forecasts on the one hand and, on the other, is rated by a recently quoted B.B.C. spokesman as "nearly always less than you expect." It is matters like these that the projected experimental transmissions should help to resolve.)

So much for stereo broadcasting, at least for the time being. At the close of his letter, quoted earlier, M.McM. makes reference to the allegedly declining standards of television.

He is not alone in this opinion, for many people have remarked to me along the lines that television isn't what it used to be.

Frankly, I don't believe it.

When television first came to Australia, it was a new experience and we gladly sat through all kinds of shows, with a good deal of enjoyment.

We don't do this any more, or to anything like the same extent. We so often find the films dated and boring. The shorter shows don't seem to hold our interest as once they did, and we are quick to criticise live shows for any small lapse.

Yet I venture to suggest that the feature movies which are available now are of more recent origin than those we saw originally. The TV shows are much better produced, as also are the live studio presentations.

For what TV is, I would suggest that it's much better now than it was in the late 1950s. The difference is that we—the audience—have become saturated with the mass of readily accessible entertainment and have lost interest as a result.

So we turn back to music or reading or other leisure activities, which a few years ago we forsook for the goggle box. But, even so, let's face it; the goggle box is here to stay and has a good deal to offer still to the discerning viewer. ■

The manufacturers of the "Ro-Fo" TRS 100-18 ignition coil used in our Transistor Ignition Systems of March-April 1964 have advised that long-term reliability is significantly improved if the points-shorted current is set to 8 amps maximum rather than 10 amps. This applies to all three versions of the design using the TRS 100-18 coil.

To set the ballast resistor for 8 amps maximum in the absence of an ammeter, it should be set to approximately 2/3 of its resistance — 1.0 ohm. However it would be preferable to set the current using an ammeter.

ACOS CHANGER DUST BUG

PRICE £2/15/-

Essential to all who value their records, the Changer Dust Bug clips easily over most changer arms and sweeps the record both before and behind the stylus, at the same time depositing a very fine antistatic film which prevents dust attraction through static changes. Record and styli life can be increased by up to five times with a Changer Dust Bug. Spare fluid, bristles and plush pad are available in complete spares kit.

AMPLION (A/SIA) Pty. Ltd.,
29 Major's Bay Rd., Concord, N.S.W.
Vic. Distributors: E. W. Cornelius Pty. Ltd.,
5 Northumberland St., Sth. Melbourne, Vic.

PIX For FAST on-the-spot cover of world events in story and pictures.

Most advanced, feature-packed pick-up arm in the world . . .

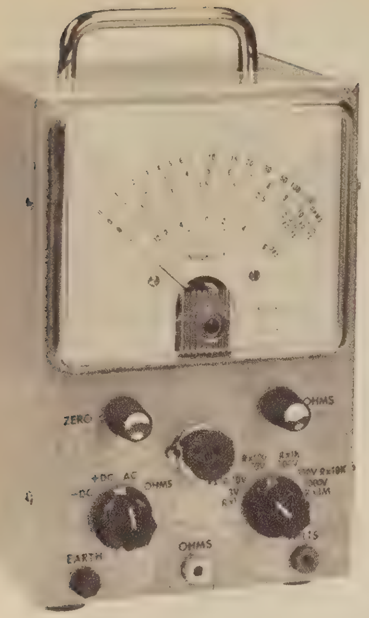
GOLDRING -LENCO P.77

TRANSCRIPTION ARM

Percy Wilson, writing in "The Gramophone" (Oct. 1965) describes the Goldring Lenco P.77 as "a thing of beauty, technically as well as in appearance." But it's more than that.
Take the accurate spherical balance, obtained by precision mechanism permitting micrometric adjustment both laterally and longitudinally. A few simple adjustments and there's balance in every plane!
Take the offset to secure good head tracking!
Take the light magnesium alloy used in the construction of this transcription arm!
The bearing friction is low—measured at the stylus—vertically and laterally it's on the order of 20 milligrams!
But read about it yourself—write or phone Goldring for a reprint of Percy Wilson's article in the 'Gramophone'—or better still a demonstration of the Goldring Lenco P.77.

GOLDRING
ENGINEERING (A'ASIA) PTY. LTD.

N.S.W.: 443 Kent Street, Sydney 29.1528
VIC.: 368 Little Bourke Street, Melbourne 67.1197
W.A.: 144A William Street, Perth 21.6500
QLD.: 235 Edward Street, Brisbane 2.3247
S.A.: 77 Wright Street, Adelaide 51.5117
GE:P256

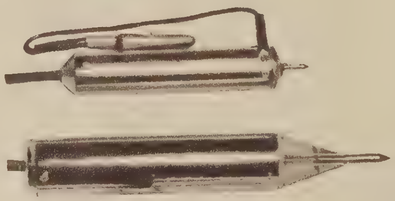


PROBES For The 1966 V.T. Voltmeter

The basic VTVM as described last month is a versatile and useful instrument and this usefulness may be increased many times by the addition of a number of external probes. Here are some suggestions on the subject of probes, which may be made up to suit the requirements of the individual.

by Ian Pogson

The front view of the VTVM shows the probe socket with shorting plug in position for normal operation. At right, two probes are shown, the crystal probe in a small housing, and another using the large housing.



THE instrument, as it was described last month, did not make provision for certain types of probes, where it is necessary to extend a heater or other form of supply to the probe housing. Space was left for a socket on the front panel and a socket has since been fitted with wiring modified, to provide these facilities. Changes in the circuit, which are very simple, are shown in figure 1. It should also be noted that a miniature 5-pin plug is needed, to short two of the connections of the socket, when probes are not in use.

Four probes will be considered, varying in detail according to the complexity and the likelihood of popularity. They are: a 6AL5 type, which has the same ranges as the instrument and good to about 30MC, a crystal diode probe limited to about 30 volts, but good to 200MC or more, an audio frequency probe with a gain of 10 and an EHT probe.

The 6AL5 probe is really a duplication of the circuit already used in the instrument for the AC ranges. However, by reducing the length of lead from the circuit under test to little more than the length of the probe tip, the loading on the circuit (mainly capacitive) is markedly reduced.

A typical application is checking frequency response of high-quality audio amplifiers. In order to check the performance thoroughly, it is often necessary to measure the response at frequencies as high as 100KC or even higher, and the combination of long leads and high impedance circuits at these frequencies may result in significant errors.

In short, wherever there is any doubt concerning possible loading effects, regardless of frequency, the valve probe will be a safer proposition than long leads direct to the meter.

The fact that high voltages may be measured is also a useful feature in such applications, since these are frequently encountered in the output circuits of high power amplifiers.

Less likely applications, but useful none the less, are measurements of RF in transmitters, where, once again, the voltage range would enable most, if not all, stages to be checked.

Where combinations of impedance and frequency are such that the amount of capacitance in the circuit is critical to within a few pF, even the valve probe may load the circuit unduly. In such circumstances the crystal diode probe is a much better proposition since, by careful construction, its input capacitance can be reduced to around two or three pF.

One typical application is the measurement of response of video amplifiers in a TV receiver. Such circuits are very critical in regard to stray capacitance and that which is unavoidable must be offset by resonating with suitable chokes. Any measuring device which added more than a few pF would be intolerable.

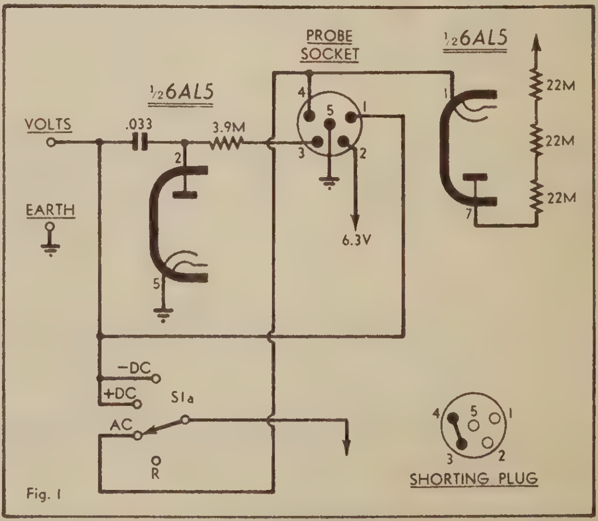
Assuming the availability of such a probe, anyone having a good quality service oscillator capable of delivering a level output up to 5 or 6MC would be able to make such response measurements.

Another very valuable application concerns observation of local oscillator activity in transistor superhets. It is difficult to measure this activity by observation of collector current or other DC conditions. However, the actual oscillation may be measured directly across the tuning capacitor with virtually no disturbance of the circuit.

Unfortunately, these excellent facilities are not achieved without some disadvantages. In deliberately keeping the input capacitance low, we prejudice the low frequency response below about 10KC, while the characteristics of the germanium diode limit the voltage which can be handled to about 30 volts RMS.

However, provided these limitations

This is how the probe socket is wired and should be read by taking the shorting plug into consideration. Contact potential bucking voltage is fed to both the internal 6AL5 rectifier and the 6AL5 probe.



are fully understood and the right probe selected for the job, they cannot be regarded as serious disadvantages.

As can be seen from figure 2, the valve probe has no serious errors up to 20MC and is still within 10 per cent at 30MC, but is virtually useless above this point.

The germanium diode extends to 50MC without appreciable error, and holds within plus or minus 10% to 200MC or higher.

It must be emphasised that these figures apply only to the probes themselves but take no regard to the effect the probe may have on the circuit under test. High impedance circuits still could be seriously loaded even at moderately low frequencies and each set of circumstances will have to be judged on its merits.

The valve probe is built into a commercial probe housing and the one which we have used was a "Jabel" type, although any other unit of similar size could be used.

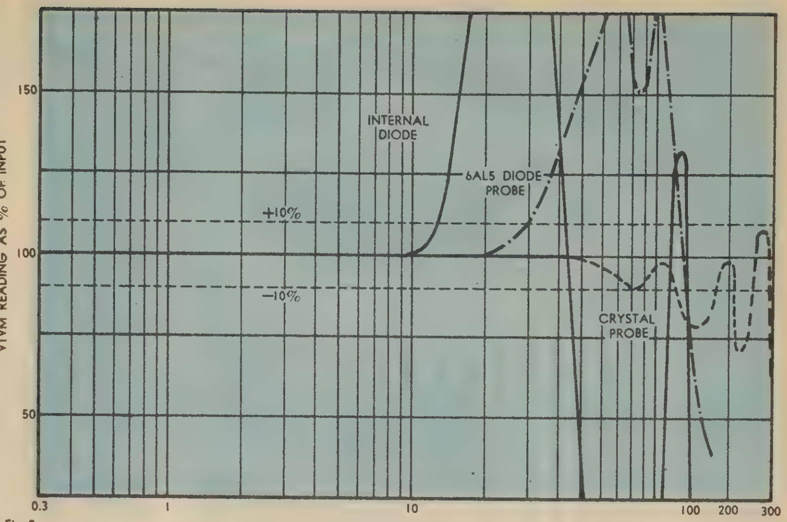


Fig. 2

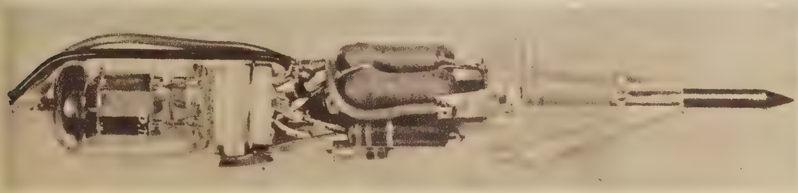
From this graph, a good idea can be gained as to the kind of performance which may reasonably be expected from the internal diode, the 6AL5 diode probe and the crystal diode probe. Allowance may have to be made for the effect that a probe may have on high impedance circuits.

As can be seen from figure 4 the valve socket is supported on an insulating pillar, the other end of which screws on to the rear end of the probe tip. The few components involved are then spaced more or less evenly around it.

The insulating pillar is a standard component measuring 1in x ¼in and tapped ⅛in Whit. at each end. Because of the manner in which it is used its insulating properties are not particularly critical.

The valve socket may be a ceramic or good quality mica filled type and any metal work fitted to it should be stripped off. To facilitate mounting it on the pillar, a ⅛in screw needs to be fitted to the central shield and this is fairly simple.

An ordinary round head screw is modified by turning down the head until it is a neat fit inside the shield. This may be done with nothing more than a small power drill and a file, the only precaution being to see that the screw is initially long enough to allow for any thread which may be damaged in the drill jaws and which will have to be cut off.



From the photograph, circuit and detailed drawing, no difficulty should be experienced in duplicating our original instrument. The calibrating resistor value must be found experimentally.

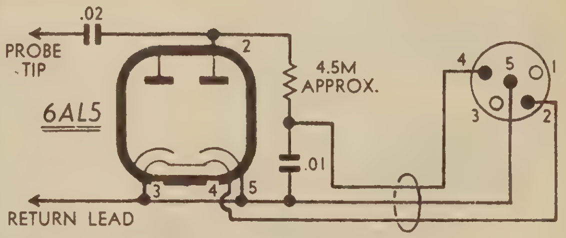


Fig. 3 **6AL5 DIODE PROBE**

A nut soldered to the end of the socket shield will assist in centring the screw and in strengthening the assembly generally. The head of the screw should be tinned before placing inside the shield. Heat applied to the outside of the shield and solder from one end will complete the job.

The .02uF capacitor is made from two tubular ceramics connected in parallel, while a third similar unit provides the by-pass on the DC line to the instrument. An insulated anchor point to terminate this capacitor, the calibrating resistor and the DC lead is provided by making a loop of 20 gauge (approximately) tinned copper wire around the base of the valve socket.

The calibrating resistor will have to be selected experimentally and usually will be about 4.5M. As quite a high voltage can be impressed across this resistance, we recommend that it be treated similarly to its counterpart in the instrument. In short, the necessary value should be spread over two or preferably three units.

A three wire cable is required for this probe and this can be made from three lengths of hook-up wire and a length of plastic tubing. About three feet of each is required. Tubing diameter should be either 4 or 5mm and if the former is used, one of the leads should be of light gauge hook-up wire, such as 5/.0076. This should be used for the DC lead.

Some form of anti-strain device should be fitted to the cable where it leaves the probe, and this may be a few turns of good quality plastic insulation tape. This same material may also be used if it should appear that any components are in danger of shorting to the probe housing.

Means must also be found to earth the metal body of the probe. About the easiest way to do this is by means of a

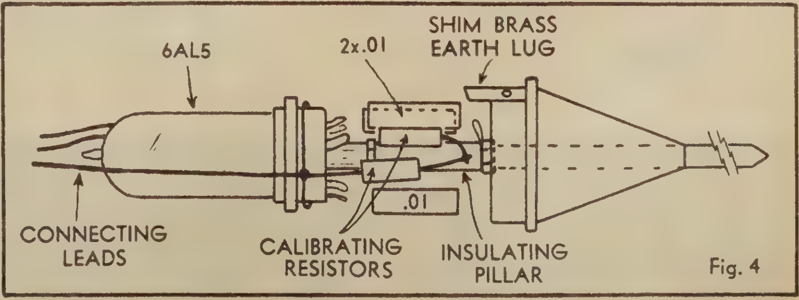
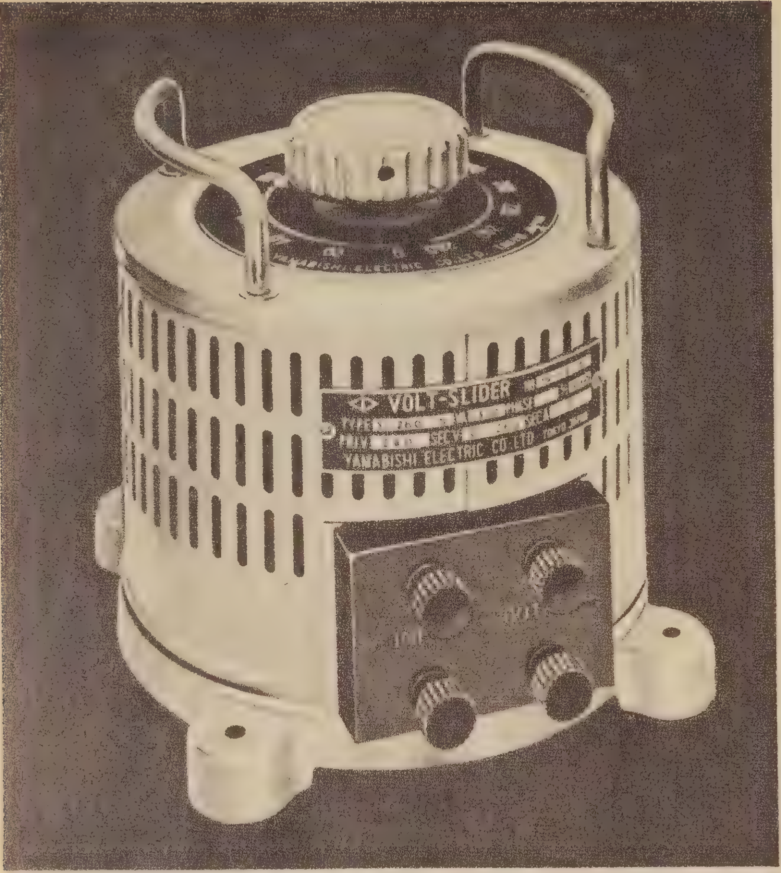


Fig. 4



Yamabishi volt sliders

proved in the Australian market over several years

ranges	1 to 100 amps single phase 1 to 30 amps three phase

standard (surface) and panel mounting types

nominal input	240 V	(single phase or per phase)
nominal output	0-260 V	(single phase or per phase)

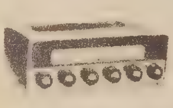
SOLE
AUSTRALIAN
AGENTS

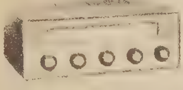
H. ROWE
& CO. PTY. LTD.

HOBART SYDNEY ADELAIDE
MELBOURNE BRISBANE PERTH

MAKE YOUR OWN FROM AN INSTROL KIT

We cater for all "Playmaster" designs from "E LECTRONICS Australia." Our kits contain ALL best quality components, precisely to specification.





INSTROL-PLAYMASTER
No. 106 Amp./Tuner

Kit of parts	$96.50
Built and tested	$117.30

No. 111 NEW PROGRAM SOURCE TUNER

Kit of parts	$39.00
Built and tested	$53.00

NOo. 4 STEREO AMPLIFIER

Kit of parts	$73.00
Built and tested	$93.80

No. 108 STEREOGRAM

Kit of parts	$59.80
Built and tested	$90.50

No. 110 TAPE AMPLIFIER
Kit of parts only

Tape Amp Unit	$63.00
Adaptor Power Unit	$31.50
STEREO REC Power Amp	$57.00

TRANSISTORISED IGNITION
("R. TV & H." March, 1964)

Kit of parts	$32.85
Roto Coil 6v or 12v	$10.70

Postage 50c.

MICROPHONE CATALOGUE. Just printed — our new free michrophone catalogue and price list, detailing a wide range of various makes and models. The range includes types suitable for P.A. work, tape recording, stage work, etc. Send for your free copy.

CANNON CONNECTORS. Full range of these high quality audio connectors always available ex-stock. Detailed price list available.

INSTROL & OXFORD METALWORK. Detailed price list available for all instrol and Oxford metalwork and labels.

COMPONENT PARTS.
We carry a wide range of electronic components and can supply ex-stock, parts for most "ELECTRONICS Australia" (and "R. TV & H.") circuits. All best quality brands such as Ferguson, Ducon, Philips, Soldering irons by Scope, Robinson & Adcola, Hi-Stab, 1 per cent resistors, etc., etc. We will gladly quote if you send us a detailed list of your requirements.

BROADWAY ELECTRONICS PTY. LTD.

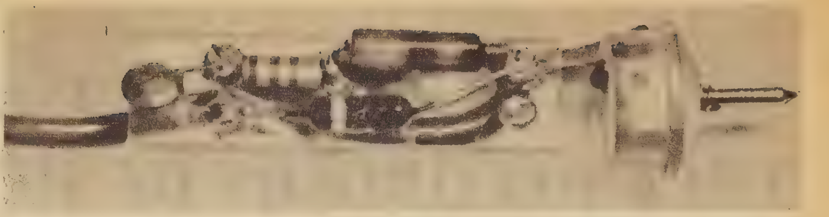
E.S. & A. BANK BUILDING, CNR. BROADWAY & CITY RD., SYDNEY
(Opp. Grace Bros.)
Phone: 211-4224, 211-4244, 211-4213

lug made from shim brass, which may be wedged between the tip moulding and the metal base. It should be drilled with a clearance hole to permit the assembly screw (a self-tapping type) to pass through it. In this way it will be held in firm contact with the metal housing.

Like the 6AL5 diode in the instrument, the diode in the probe presents the problem of contact potential. We have wired the probe socket so that the same bucking potential which is normally fed to the internal diode is applied to the probe diode as well. Now it will be argued that the amount of contact potential developed will vary from one diode to another. This is true, but it has been reasoned that it is better to reduce this nuisance, even if it is not perfectly cancelled. However, if it happens to be possible to compare different 6AL5's, it is possible to get two which will match up quite well, as we have done with our instrument.

If it is not possible to match up a pair of 6AL5's, then it will be necessary to re-set the zero for each range of the probe, by means of the Zero control on the panel of the instrument. After using the probe, the Zero control will have to be re-set in the usual way for normal use of the instrument.

The germanium diode probe will fit into a smaller housing and the one shown in the photograph is built into a housing made by University Graham Instruments. However, a home-made housing, or any similar commercial unit could be used. In the past we have fitted such a probe into the shell of an old metal valve, such as the 6AC7.



The photograph and figures 5 and 6 gives complete details of the construction of the crystal diode probe. An alternative housing and board are available as explained in the text.

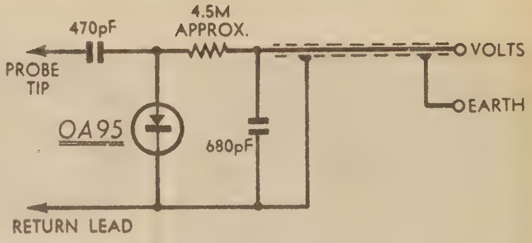


Fig. 5 **CRYSTAL DIODE PROBE**

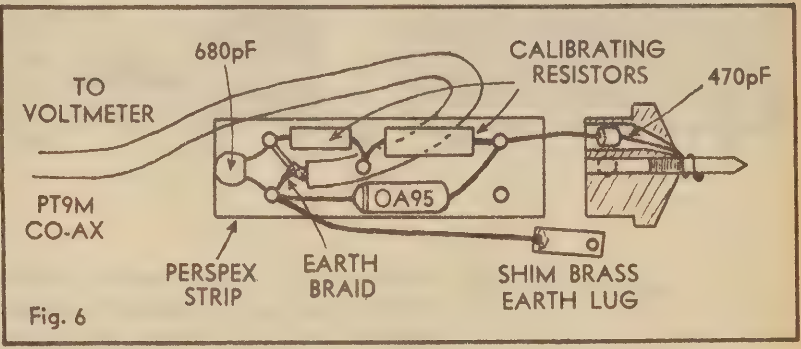


Fig. 6

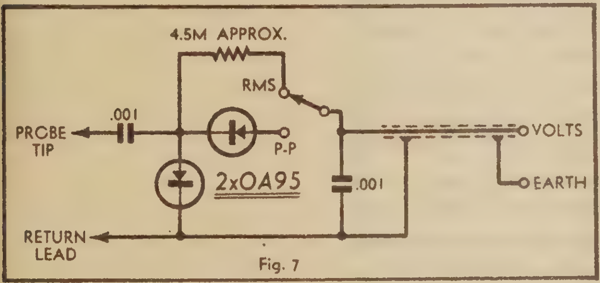


Fig. 7

This circuit shows how a composite crystal diode probe may be made to read either rms or peak - to - peak values of voltage. Calibrating resistor is found experimentally.

The housing which we used on this occasion was supplied with a small perspex panel, so we mounted the components on it. This method of construction may be followed in principle, whatever housing you happen to use.

The most important requirement with this probe is to cut down the input capacitance to an absolute minimum. One step is to remove portion of the threaded section of the probe tip, leaving about ¼in only, which is still adequate to hold it in the moulding.

The 470pF coupling capacitor is a ceramic bead type and is fitted into a ¼in diameter hole drilled in the moulding alongside the probe tip. A small hole at the bottom of this allows the pigtail from the capacitor to pass through to the probe tip, to which it is to be soldered.

This soldering operation requires a little care in order to avoid damage to the plastic moulding. The correct spot on the tip should be noted, the tip removed from the moulding and this spot tinned. The pigtail also should be tinned, the tip replaced in the moulding and the pigtail wrapped around it once or twice. Finally, the quick application of a very hot iron, such as a Scope, will enable the two blobs of solder to be melted together without imparting excessive heat to the tip.

The perspex panel was ready drilled and we did not find it necessary to add any holes. We fitted a small tubular rivet to each hole to serve as a terminal but small nuts, bolts and solder lugs also could be used.

The general disposition of the components will be clear from figure 6 but a few additional points are worth noting. The perspex panel is a neat sliding fit inside the probe housing and will thus keep all components clear of the latter, provided they are correctly mounted.

Since this panel is not rigidly supported, it must be protected from any form of strain or twist via the cable. Strain may be prevented by simply binding the cable at the appropriate point with light gauge tinned copper wire, but this provides no protection against twist.

To provide this, we drilled and tapped an 8BA hole into the inner face of the metal plug at the rear of the housing and fitted it with an 8BA RH screw. A loop of wire from the binding is then taken under this screw and the latter tightened on it. It is important to leave a loop of cable in the housing as shown in figure 6, to facilitate assembly.

Care should be exercised when soldering the germanium diode into circuit, due to the possibility of damaging this device by excessive heat. Hold each pigtail with a pair of long-nose pliers while soldering and until the joint has cooled.

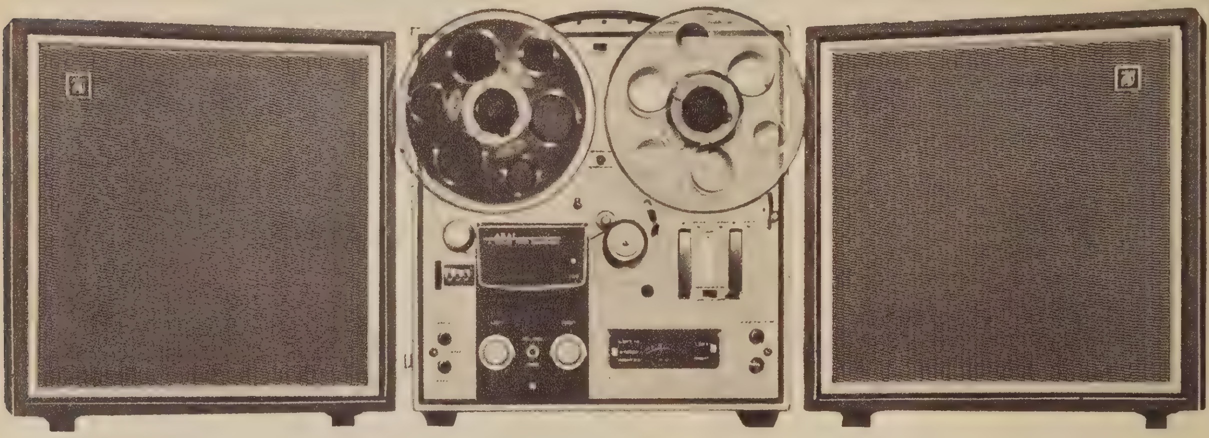
The probe housing is earthed internally in the same manner as before and it is also necessary to fit an external earth lead. A solder lug is fitted to the outside of the probe, directly outside the shim brass lug, and to this is connected a few inches of lead, terminating in an alligator clip. It should almost go without saying, that the higher the frequency of the voltage being measured, the shorter should be this lead.

Since two conductors only are required for this probe, PT9M coaxial cable is a good choice. The centre conductor and the braid should be terminated in banana plugs, to fit the appropriate sockets on the instrument. As a negative voltage is fed from the probe, it is only neces-

CIRCUIT ERRORS

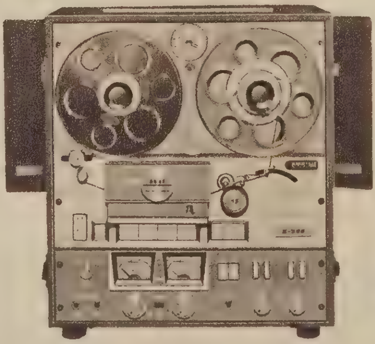
In the 1966 VTVM circuit, the "+DC" contact on S1d should also go to pin 3 of the 6CG7 valve. On S1c, the "+DC" contact should go to the other side of the "DC CAL." potentiometer.

WITH PRIDE WE OFFER TAPE RECORDERS OF REAL QUALITY



MODEL 1700 **Amateurs Can Enjoy Professional Results without paying professional price.** This compact model is a 4-track stereo/monaural record and playback tape recorder. It is light in weight and even ladies can carry it gracefully with ease. You get the same Akai quality at this surprisingly low price. It has a frequency response of 40 to 18000 cycles per second; 3-speed (1⅞, 3¾, and 7½) and 15 ips optional; two built-in speakers; automatic stop; simple change-over to AC power. This Akai Model 1700 is selling exceptionally well in the United States under the brand name Roberts 1630. The matching stereo speaker Model SS-30 is also available.

MODEL **355** Cross-Field head plus Solid State Amplifier * Music Power 50 Watts (25 watts each) * 4-track stereo monaual record and play back * 3 speeds (3¾", 7½" and 15" per sec.) * Frequency response—30 to 24,000 cps. at 7½" per sec. * Two built-in speakers * Automatic reversing and repeating playback * All push button operation * Automatic stop and shut-off * Remote controls available * Unit card system amplifier included * Simple change-over for the necessary AC power



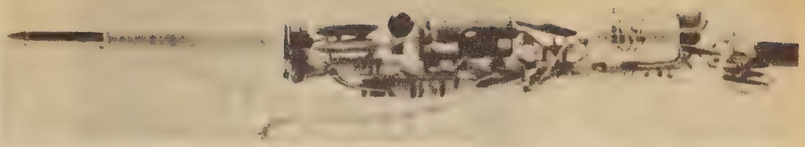
AKAI®
TAPE RECORDER

AKAI ELECTRIC CO., LTD.
HIGASHIKOJIYACHO OHTA-KU TOKYO JAPAN
MAGNECORD AUSTRALASIA PTY LTD.
158 Clarence Street, Sydney Tel. 29 5127

sary to feed its output into the VTVM, set to the required minus DC range.

Another commercially available housing for the crystal diode probe is the 2in-long "Jabel" version. Available from the same source for the component panel is a material called Veroboard. A piece of this board, just wide enough to fit into the housing, may be used in a similar manner to the way we have used the piece of perspex in this role.

Before leaving the crystal diode probes, here is an idea that may be useful to some readers. By adding a switch to the crystal probe and exchanging the 4.5M calibrating resistor for another OA95 crystal diode, the circuit becomes a peak-to-peak detector, as shown in figure 7. The reading on the meter will then be 2.8 times the RMS value. The limiting voltage level will be of the order of 90 volts.



Construction of the audio probe must be undertaken with care, so that all components may be fitted into the limited space. The photograph, circuit and wiring diagram should be of considerable assistance in this task.

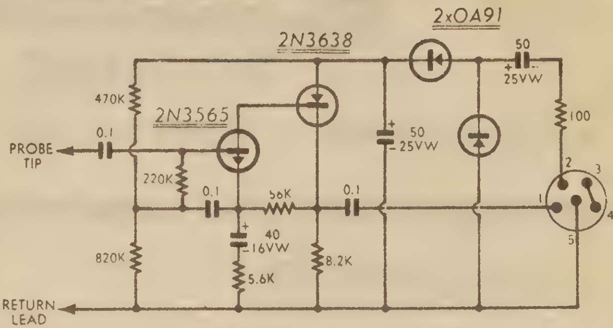


Fig. 8

x10 AUDIO FREQUENCY PROBE

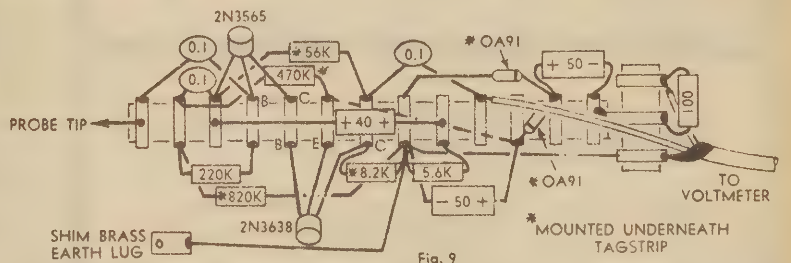


Fig. 9

Although we have not shown a made-up unit of this version, we have indeed tried it and it works out very well in practice. It may be necessary to use a larger diameter probe housing than the one we have featured, in order to fit the switch. The switch may be a slider type, which is readily available.

The audio frequency probe consists of a two-stage transistor amplifier with a gain of 10. It will accept signals up to 300 millivolts, which will give a full-scale reading on the 3V AC scale. The frequency response is virtually flat from 30 cycles up to 20KC, with a gentle roll off below and above these figures respectively. The input impedance is of the order of four megohms, which means that it is high enough not to load most circuits unduly.

A probe of this type should be very useful to readers who wish to make measurements on items of audio equipment such as pickups, microphones, etc. In fact, many uses may be found for this probe, where low levels of AC voltages are to be measured, restricted only by the frequency and signal level ranges.

The unit is built into a standard "Jabel" probe housing. Before proceeding with a description of the construction, here is a word of warning. We had quite a problem to solve on the score of getting all the components into the probe housing. Constructors should therefore be very careful in their choice of components, particularly with respect to shape and size.

The amplifier, together with its voltage doubler power supply, is built on to a miniature 13-tag strip, supplemented with a three-tag strip at the power supply end. Figure 9 shows how we have mounted the components on the strips and this should be followed carefully, in association with the photograph.

We found it necessary to prune the input end of the tag strip, almost back to the first tag. The three-tag strip is soldered with its centre lug to the lug at the other end of the main strip. The small strip should be soldered into position so as to keep the overall length of the assembly down, to ensure that it will fit in between the two end pieces of the housing assembly.

This done, the wiring and mounting of components is next. Do not rush this part of the job. Each component must be carefully considered and must be checked to make sure that it will fit into the barrel of the housing. We found it expedient to mount the 470K, 820K, 56K and 8.2K resistors and the two OA91 diodes on the back of the strip. All other components are fitted on the front. Care should be taken to avoid any short circuits.

A lug is fixed under the nut on the rear of the probe tip. The input lug of the amplifier assembly is then soldered to the lug on the tip. The cable between the probe and the instrument is two-core, with braid shielding. One lead is used for the output, one for the 6.3 volts AC, with the braid for the earth return.

A spare lug on the end three-tag strip is used to anchor the earthing braid and the other two cable leads are terminated at the appropriate points. It is also necessary to earth the probe housing and this is done in a similar manner to the other probes, by using a small piece of shim brass wedged in between the tip moulding and the metal tube.

Although we have gone to some trouble to make sure that the amplifier does, in fact, have a gain of 10, readers who have the facilities may care to make a final check on the instrument before it is put into use. Variations in component tolerances may result in some change in gain. This can be altered by reducing the value of the 5.6K resistor if the gain is too low and increasing the resistance if the gain

MILLER IF STRIP
Miniature pretuned IF Strip. Gain 50 dB. Selectivity 8 Kcs. at 6 dB. Dimensions 1.5in x .55in x .51in.
$7.70 each. Plus tax.
ASTATIC Hand Microphones. Ceramic with wide temperature tolerance with immunity to humidity. Semi-directional, attractive, rugged and dependable. Ideal for amateur, mobile and communications use. $8.00. Plus tax.
Also Available:—
Electrol encapsulated reed relays, complete with coils 6-12-24 volt D.C. coils.
Dialco Pilot Lights.
Wima plastic film capacitors. Polycarbonate unpolarised to 10 mfd. small case size.
AUGAT integrated circuit breadboards, transistor sockets and hardware.
Manufacturer inquiries welcomed. We specialise in miniature components.
A. J. FERGUSON (ADELAIDE) PTY. LIMITED,
189 FLINDERS STREET,
ADELAIDE, S.A.

AMATEUR ASTRONOMERS SUPPLY CO.
17 Alexander St., Crow's Nest. Sydney.
Phone: 43-4360.
FREE CATALOGUE: ● Build-it-yourself kits ● Telescopes ● Optical Parts ● Binoculars ● Books ● Star and Lunar Atlases.
ASTRONOMICAL TELESCOPES from $21.00

ADCOLA

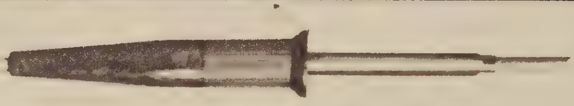
"M" SERIES

SELECTED AS
Good Design
FOR
AUSTRALIAN
DESIGN INDEX
INDUSTRIAL
DESIGN COUNCIL
OF AUSTRALIA

AUSTRALIA'S LEADER IN MODERN PRECISION SOLDERING TOOLS

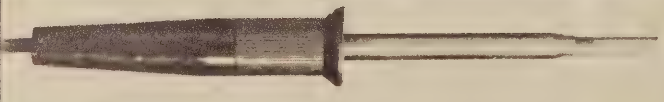
M70 Tip Shaft Dia: 1/8" Rating: 19 watts Weight:* 3 ozs. Application: Transistor, miniature and micro-miniature electronics and instrument work.

M64 Tip Shaft Dia: 3/16" Rating: 23 watts Weight:* 3½ ozs. Application: Standard tool for radio and television assembly and servicing.



M107 Tip Shaft Dia: 1/4" Rating: 27 watts Weight:* 4 ozs. Application: Servicing in telecommunication centres and similar heavier tagging.

*Weight of tool only, without cord set.



M150 Tip Shaft Dia: 5/16" Rating: 45 watts Weight:* 6 ozs. Application: General Purpose Solder Tool, sheet metal, earthing strips and other heavy duty work. Tip incorporates unique anti-seizing ferrule

LONG LIFE TOOLS, TESTED AND PROVED IN WORLD-WIDE SERVICE.

Adcola "M" Series soldering tools are long-life precision-made tools, the result of 20 years' development to meet the particular needs of the Communications and Electronics industries throughout the world.
They are standard equipment in all Australian Armed Services, Space Tracking establishments, P.M.G.'s Department, major computer firms and numerous other organisations with the resources to carry out stringent comparative pre-selection tests on soldering equipment.

GREATER THERMAL EFFICIENCY

The advanced design reduces heat losses to a minimum and provides a work capacity in each model normally associated with conventionally designed tools of twice the rated power. Initial heat-up time (60 seconds for M70, 100 seconds for M64) and heat recovery are extremely rapid. Elements are calibrated to provide optimum tip temperatures for swift and sound soldering of terminations in each type of circuit.

DESIGNED FOR ACCURATE SOLDERING

The lightness and balance of the "M" Series tool; the flared handle, ribbed for a positive precision finger grip; the slim heater unit allowing the best possible visibility and penetration; the combination of these design features allows easy, precise manipulation and therefore better soldering.

INSTANT CONTROLLED HEAT

A constant heat tool operating at the correct soldering temperature ensures the swiftest and most efficient soldering. Poor quality soldered joints caused by too high or too low a soldering temperature are avoided. Fitted with a hook for suspension while idling, Adcola soldering tools will operate continuously without risk of overheating or loss of tip tinning. Heat sinks, idling or cut-off switches are **NOT** required.

EASY REMOVAL OF TIP

The tip is held firmly by a stainless steel collet, and is easily removed for cleaning and replacement and to allow quick fitting of special-purpose tips.

SAFETY FIRST

Safety was a primary consideration in the design of the "M" Series, which embodies a fully insulated element and a double-earthed helical wire outer casing to the heater unit. Every heater unit must pass an insulation test of 2,000 volts before release from the factory.

NO TRANSFORMER REQUIRED

Adcola tools conform to S.A.A. approval and test specifications and are approved in all States for mains voltage operation.

All models are available for 230-250V, 200-220V, 100-120V, 50-55V, 32V, 24V, 12V and 6V.

ADCOLA PRODUCTS PTY. LIMITED

12 CHURCHILL STREET, MONT ALBERT,
MELBOURNE, E10, VICTORIA, 88-4351

N.S.W. Distributor: H. ROWE & CO. PTY. LTD.: 512 PUNCHBOWL ROAD, LAKEMBA. TEL.: 75-0681.
Qld. Agent: T. H. MARTIN PTY. LTD.: 35 CHARLOTTE ST., BRISBANE. TEL.: 2-1785.
W.A. Agent: C. L. SEDUNARY & CO.: 126 BROWN ST., EAST PERTH. TEL.: 21-6607.
TAS. Agent: H. ROWE & CO. PTY. LTD.: 231 LIVERPOOL ST., HOBART. TEL.: 34-3860.

is too high. Although the amplifier has a gain of almost 100 with the 400uF capacitor connected directly to earth, it is not recommended that this gain be sought after, as the frequency response deteriorates with an increase of gain.

Before slipping the amplifier assembly into its case, means should be provided to avoid any possibility of a short circuit between any of the components and the case. The voltages involved are quite low and so a lining of stout paper on the inside of the case would be sufficient.

Finally, we come to the EHT probe, which is the same as the one which was described in February, 1959, for the Bench Type VTVM. As described, it was a times 100 multiplier for the DC ranges. The input resistance of the Bench Type VTVM was 10M and the resistance of the probe is 990M.

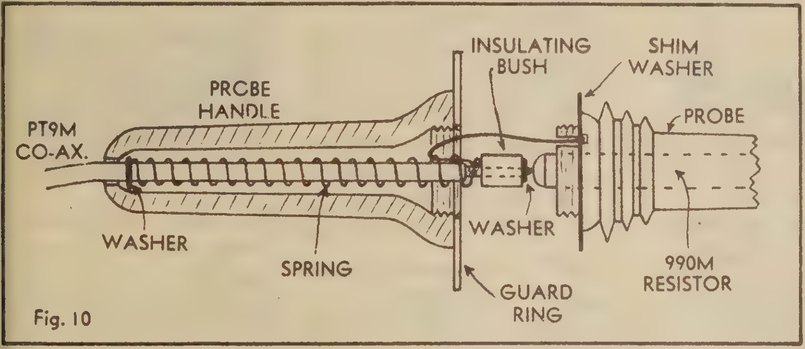


Fig. 10

A spring is used to hold the resistor in place. A shim washer is also used to effect a positive earth connection to the guard ring. Allowance must be made for error in reading when using this probe with the 1966 VTVM.

Now the input resistance of the 1966 VTVM is 10.94M on the DC ranges. With 990M in the EHT probe, there will be an error in readings. In fact, the readings obtained under these conditions will be just over 7½ per cent high. So long as this point is known and allowed for, there is no reason why this probe should not be used with the new VTVM.

Neglecting the error just referred to, with the VTVM range set to 300 volts, the probe will then extend the range of the meter to 30KV. However, we are not limited to this range. The 100V and 30V ranges become 10KV and 3KV respectively, and these could be extremely useful ranges to have at one's disposal.

The 10V range naturally becomes a 1,000V range, which is already covered in the instrument itself. However, the higher impedance of the circuit could be valuable on occasions.

At the other end of the scale the 1,000V range becomes, theoretically, a 100KV range. However, voltages requiring such a range are unlikely to be encountered, plus the fact that there may be some doubt as to the ability of the insulation to withstand such pressure. At most, such a range should be used to check a voltage which may be slightly outside the scope of the 30KV range, and then only if extreme caution is exercised.

Electrically, this probe is delightfully simple. It is merely an external resistor connected in series with the active lead, so as to form a voltage divider in conjunction with the input resistance network within the instrument.

In practice, however, it is a little more complicated than that. The resistance required to give 100 times multiplication works out at 990M with a 10M input resistance. In the special case for the input resistance for our instrument, of 10.94M, the probe resistance really should be 1,080M. This is a lot of resistance no matter how one looks at it. Any suggestion of making up this value from standard resistors is quite out of the question.

The only possible approach is to use a resistor specially made for the job. Although these are not normally readily available, they may be obtained on special order. Unfortunately, these are not cheap, costing several pounds, but this is unavoidable.

The one we used was made by I.R.C. but other makes may be available, either now or in the future. This element is 6in long, 5/16in diameter, and fitted with axial screw terminals and solder lugs. It is supplied with a protective plastic cover, and it would seem to be unwise to remove this or to allow the actual resistance element to be handled in any way. The accuracy is given as 2 per cent.

Having obtained the resistor, the next thing is to house it in a suitable probe, remembering the order of voltages with which it is likely to be used. Such a housing is made by University Graham Instruments Pty. Ltd.

The unit is made in two parts, the probe proper which houses the greater length of the resistor, and the handle. The two screw together with a metal disc between them to serve as a guard ring. This latter is earthed when in use and serves to guard the operator.

To provide an earth connection for the guard ring it is desirable to use a shielded cable, and PT9M coaxial cable or similar is quite suitable. Since nearly all the voltage being measured is applied across the probe resistor, this cable does not require anything special in the way of insulation.

At the instrument end, the cable is terminated in two banana plugs, the braid connecting to the earth socket and the central conductor to the active volts socket. Also connecting to the earth plug is a length of lead terminating in an alligator clip. This is an earth lead, which should be connected to the earthy side of the equipment under test, in case there is no direct connection via a common mains supply.

Figure 10 shows how the probe housing and resistor are assembled and this should be sufficient information to put the unit together.

HIGH QUALITY CRYSTAL MIKES, PRIMO 127A DESK TYPE, TILTING STAND, LEAD AND PLUG:

$4.50
(45/)
Post Free

MULTITESTER WITH A.C. CURRENT RANGE
Model MT-94-A
20,000 O/V
7 5/16 x 5¼ x 3 inch
Volts DC & AC: 0-2.5 - 10 - 50 - 250 - 1000. Current DC: 0 - 100 UA, 0 - 25 - 250 MA, 10A. Current AC: 0-1-2.5-10A. Resistance: 0 - 5-50 500 KO, 5 MO Decibels:—20 + 46
$46.40
(£23/4/-)
Post 60c

Model 81A
20,000 O/V
6 x 4 5/16 x 2¼ inch
Mirror Scale
Volts DC & AC: 0 - 10 - 50 - 250 - 500 - 1000. Current DC: 0 - 50 UA, 0 - 25 - 250 MA. Current AC: 0 - 10A. Resistance: 0 - 5 - 50 - 500 KO, 5 MO. Decibels: — 20 + 36
$26.60
(£13/6/)
Post 60c

K-140 VOLT-OHM-MILLIAMETERS 6 INCH CLEAR VIEW FACE
DC & AC Volt: 0-5000 Volt
DC Current: 50 UA-10 amp
Resistance: 0-20 MO
Decibels: — 20 + 50
$47.20 (£23/12/-)
Post 60c

SANWA AG 202 AUDIO GENERATORS
20-200 KC
$79.00 (£39/10/-)
Post 80c
TC-2 Tube testers
$35.20 £17.12.0 post free
SE-100 Transistorised variable Power supply
$19.60 (£9.16.0) post free
SE-250 Signal injectors
$5.50 (£2.15.0) post free
SE-200 Minilabs
$18.75 (£9.7.6) post free
SE-350 Signal tracers
$27.50 (£13.15.0) post free
2-station intercom
$11.50 (£5.15.0) post free
All prices including Sales Tax

MINITHERM PRODUCTS
POST BOX 151
DOUBLE BAY POST OFFICE
(Established 1949)

Special Bargains from
RADIO HOUSE PTY. LTD.

TRANSISTOR TAPE RECORDER

Model 999A $31.50 (£15/15/-)

Plus post., 75c.
Reduced from £22/10/
Complete with Tape Battery
Phone and Mike

SPECIAL PURCHASE

Car FANS from West Germany, with plastic blades and suction cap fitting.

6 volt $3 (30/-)
12 volt $3.95. (39/6)

Posted anywhere 25c extra.

MULTIMETER TESTERS

Model RH-50

Modern Design, 33 Micro Amp Meter.

30,000 Ohms per Volt D.C.

13,000 Ohms per Volt A.C.

1 p.c. Multipliers and Shunts used. Printed circuit.

Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.
AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 Ohms per volt.
DC Current: 0-.06-6-60-600 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW. 600 ohms).
Audio Out: Capacitor in series with AC volt ranges.
Short Test: Internal buzzer.
Accessory: 1 pr. heavy test leads.

Price $31 (£15/10/)
Postage 50c to $1 extra.

Batteries: 1 (1.5V), 1 (15V).
Size: 3 5-16" x 6 5-16" x 2¼"
Weight: 1.4lb approx.

LIMITED STOCK ONLY

Model RH-10

RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.
AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.
DC Current: 0-500uA 0-500 mA.
Resistance: 0-10K-1 Meg: 60 ohms, 6 Kohms at centre scale.
Capacitance: 250uuF to 1uF, in two ranges.
Decibels:—20 to plus 36db, two ranges.
Output: 0-1,000 V in four ranges.
Size: 5in x 3½in x 1¼in.
Weight: 13oz approx.

Price $10.75 (£5/7/6)
Postage 50c to $1 extra.

Model RH-5

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000 V (20,000 Ohms/V).
AC Voltages: 0-10-50-250-500-1000 V (10,000 Ohms/V).
DC Current: 0-50uA, 0-5-50-500mA.
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10Meg. (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale).
Capacitance: 0.0001uF-0.005uF, 0.05uF-1uF.
Decibels: minus 20db to plus 36db in 2 ranges.
Dimensions: (3¼" x 5¼" x 1¼").
Weight: 15oz approx.
Complete with internal battery, testing leads with prods.

Price $18 (£9/0/0)
Postage 50c to $1 extra.

PORTABLE TRANSISTOR TAPE RECORDER

"SUNACE" PD 401

$21.00 (£10/10/-)

Postage 75c (7/6)

Complete with Mike, Battery and Tape.

MODEL TP-5 POCKET VOM. TESTER

RANGES:

- DC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
- AC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
- DC Current: 0-500uA. 25uA. 500mA.
- Resistance: 0-20K. 0-2Mg. OHMS.
- Capacitance: 500uuF to 0.1uF at 100V AC. 0.01uF to 2uF at 5V AC.
- Decibels: minus 20 DB to plus 48DB in 5 ranges.

RX10
RX1000
TP-5 TMK TESTER

£5-17-6

$11.75

NEW FROM GERMANY

THE OXFORD CORDLESS ELECTRIC RAZOR

Battery Operated

Twin blades rotary cutting head, spare batteries, 15c (1/6).
Size 5in x 1¼in.

$7.95 (£3/19/6)

SPECIAL OFFER
ALL TRANSISTOR MANTLE RADIO
$11.95 (£5/19/6) Postage 50c

RADIO HOUSE PTY. LTD.

PHONE 26-2817

306-308 PITT ST., SYDNEY. Also at 760 George St. and 6 Royal Arcade.

The Serviceman

HAVE BATTERIES CAUGHT US NAPPING?

One aspect of servicing which seems to have caught a lot of people unprepared is the recent rapid developments in the battery industry. And, whereas a few years ago a battery was regarded as a necessary evil, to be tolerated until mains power was available, the development of transistor devices and cordless appliances has put this device right back in the running as a major component.

Once upon a time there were effectively only two kinds of batteries; "wet" and "dry," and everyone knew the difference. "Wet batteries could be recharged, "dry" ones could not. Fortunately — or unfortunately, depending on which way you look at it—this delightfully simple arrangement no longer holds. Today there is a whole range of batteries available in both the "primary" (nonrechargeable) and "secondary" (rechargeable) types, with characteristics undreamed of a few years ago.

In view of this, and the equally rapid growth of battery operated appliances, it would be very wise if we, as servicemen, did a bit of brushing up on the subject. For a start I suggest you pull out your old text books and refresh your memory on the older types. Then approach the various battery organisations for technical literature on the later types, and bring yourself right up to date.

Naturally, the above comments were prompted by a story. It all started when one of my best customers and one who, for various reasons, I like to keep on the right side of, asked me if I could give him some advice about a portable tape recorder and, in particular, the battery from which it operated.

This customer is a writer by profession, which is one reason I like to do him a favour when I can. A source of professional advice can prove very valuable for one who is more at home with a soldering iron than a typewriter and I have had reason to be thankful for his help on more than one occasion.

As a writer, this fellow travels the country extensively, gathering material from all kinds of odd corners of the continent. And what better way to record his impressions, his interviews with odd characters, historical facts etc, than with a tape recorder? It saves a tremendous amount of time, preserves spontaneity and leaves nothing to chance and the vagaries of memory. In short, a "tool of trade" every bit as necessary as his typewriter.

This is particularly true of the latest transistorised portable types, and he recently treated himself to a high quality imported model to replace his old mains operated one.

Naturally, he brought it around to show it off, and I had to admit it was a fine machine. Small and light enough to sling on one's shoulder without discomfort, it could record — at its lowest speed —eight hours of speech on a five-inch reel of tape and run for something like this period on one charge of its internal battery. Alternatively, it could be run from the mains from a small power pack which also served as a battery charger.

It seemed like an ideal machine for the job, and my friend went off on one of his regular jaunts into the outback, confident that he had solved a number of problems

I didn't see him again for over six months and when I did, his visit was more than just a social call. The recorder, I learned, had not completely lived up to expectations.

"Oh, the machine itself is all right," he hastened to assure me. "In fact, it behaved beautifully, and did everything I asked of it. Its the battery that has me worried, and I wondered if you could give me some advice."

He went on to explain that, when new, the battery had performed very much as it was supposed to, giving something like eight hours running at a charge, even though he seldom needed this kind of performance. More recently, however, he had become aware that it was necessary to charge the battery much more frequently; a charge would last about a couple of hours, the maximum period he usually used it for at any one time, then progressively deteriorated until it was now down to about three-quarters of an hour, which was virtually useless.

As a result, he now wanted some advice before investing in another battery—which incidentally, was going to cost a good deal more than a new battery for his car, even though it was only a fraction of the size. In particular, he wanted to know why the battery had failed or, at any rate, whether another battery was likely to do the same thing or whether this was an isolated case of bad luck.

Then, unless he could be reasonably assured that a new battery would give a better performance, he wanted to know if there was any other kind which I could recommend as being more suitable.

My first reaction was to inquire what kind of battery was involved.

"It's a nickel-cadmium, or so I was told when I bought the recorder. Actually, there is no mention of the battery type in the manual, but it does say that it may be safely left for periods of up to six months between charges. From what I know of batteries, this seems consistent with a nickel-cadmium type. Just the same, this is something I would like to confirm."

I replied that I would like to confirm it also, since it seemed to be the crux of the whole problem. If it was a nickel-cadmium type, then it certainly should not have failed in such a short time. On the other hand if it was not—as we were both beginning to suspect — the statement in the manual about six-monthly charges was itself highly suspect.

I decided, as a first step, to contact the service department of the local agents. Surely, I reasoned, there should be someone there who could give me a definite answer, even if some of the sales types did not know the difference between one kind of battery and another.

Thus it was that I found myself talking to someone in the service department. When I decided the type of equipment and asked him what kind of battery was used in it he replied, without hesitation, that it was a nickel-cadmium type. I must confess that this was not the answer I expected but, having received it, I pressed on to the next logical question. If it was a nickel-cadmium type, why had it failed after such a short period?

His immediate reaction was to inquire how the battery had been looked after and, while I couldn't give him precise details, I pointed out that it was only a little over six months old and that, according to the manual, it should be possible to leave the battery for this length of time between charges without detriment.

His reply to this was that in their experience, this type of battery needed to be kept fully charged at all times. If it was left on the shelf without charging for only a few weeks, it would be seriously damaged.

By this time I was more suspicious than ever as to the type of battery because, as I pointed out, this behaviour was not in keeping with that of a nickel-cadmium battery. In fact, it was very much more like that of a lead-acid battery.

However, the manager was adamant. The manufacturers had told them that this was a nickel-cadmium battery and, as far as he was concerned, that was what it was. (Nor can I blame him really.) But I must confess that I was rather shocked at some of the statements that followed. As far as he was concerned, nickel-cadmium batteries were no better than lead-acid batteries, when it came to shelf life, and he went on to cite several cases which proved, at least to his satisfaction, that this was so.

He might have convinced me too, or at any rate raised some doubts, had it not been for one rather surprising statement. "The nickel-cadmium battery, that is the rechargeable nickel-cadmium battery—there are others that are not rechargable, like the little button types about the size of two shillings—must be kept charged at all times."

I'm afraid I did a mental double take on this. The suggestion that there were two types of nickel-cadmium batteries, one rechargeable and one not rechargeable, was more than I could swallow. Any credence I might have given to his statements before this was completely destroyed. I have no doubt

Built-in MW Stereo circuits bring you new simplicity and convenience in MW Stereo broadcast listening. There's RIAA compensated phono input for magnetic cartridge, plus inputs for crystal or ceramic cartridge and stereo tape recorder or other program source.

Model W-26 (24 WATTS)

- OUTPUT POWER: 24 Watts total Music Power, 12 Watts per channel (IHF Standard at 1% harmonic distortion)
- USABLE SENSITIVITY: MW 1, 2; 10 microvolts 1000 kc SW; 30 microvolts 7Mc (Input required for S N 10 db)
- SPECIAL CIRCUITS: Loudness Control, High Filter, Tape Monitor.
- DIMENSIONS: Width 17-11 16″, Height 5-13 16″, Depth 14″.
- NET WEIGHT: 29 Lbs.

SOLID STATE INTEGRATED STEREO AMPLIFIER Model TK-400E (90 WATTS)

Silicon Power Transistor

- OUTPUT: 90 Watts total music power (IHF Standard) or 45 Watts per channel. 32 Watts RMS power per channel.
- TRANSISTORS & DIODES: 21 Transistors, 5 Silicon diodes, 2 Germanium diodes.
- DAMPING FACTOR: 20 0.3% at 25 Watts (1000 cps) 1% at 40 Watts (1000 cps).
- EQUALIZER: RIAA (Phono), NARTB (Tape).
- DIMENSIONS: Width 15¼ ins., Height 5¾ ins., Depth 12¼ ins.
- NET WEIGHT: 27 lbs.

MANUFACTURED BY TRIO CORPORATION
13 MITAKE-CHO, SHIBUYA-KU, TOKYO, JAPAN

TRIO
U. S. A. BRAND
KENWOOD®

the sound approach to quality

MW-MW-SW STEREO TUNER AMPLIFIER Model W-26 hat he might have had a good practical knowledge of tape recorders, but it was plainly obvious that he knew next to nothing about batteries.

And, since there didn't seem to be much point in flogging the theme any further, I decided to leave it at that. If I wanted to know what kind of battery was involved, I would have to find out for myself.

I went back to the recorder and took a closer look at the battery. It was a small rectangular block of moulded plastic completely sealed, and with two flat contacts moulded into the top. There were some foreign hieroglyphics printed on the case but, apart from such obvious data as the voltage and ampere-hour capacity, they meant nothing to me.

But something else I noted did mean something. Although the battery case was moulded in one piece, the divisions between individual cells were clearly discernible—and it was obvious that the battery was composed of three cells.

This immediately indicated two things: It could not be a nickel-cadmium battery, because it would be impossible to generate six volts (as marked on the battery) from three nickel-cadmium cells. And it was almost equally certain that it was a lead-acid battery since, as far as I know, this is the only type that generates a nominal two volts per cell.

Now that this point was beyond doubt, the remaining facts began to fall logically into place. My friend had taken both the salesman and the instruction manual at their word, and treated the battery as if it was a nickel-cadmium type. And, while he certainly hadn't abused it on the basis of it being this type, he equally hadn't worried unduly about those occasions when circumstances made it easier to leave the battery than to charge it, firmly believing that no permanent harm would result.

In fact, the instructions given in the manual were just about as wrong as they could be for a lead-acid battery, and could not have been better designed to ruin the battery, had this been the deliberate aim. Nor was the situation improved by the salesman's error—and I now believe it was a genuine error—in classifying the battery as a nickel-cadmium type. Had my friend known it was a lead-acid type, his own experience would have been sufficient to guide him in its care.

In summary, then, I felt that both the manufacturers and the local agents were in some measure responsible for the battery's untimely failure. Had the former issued more accurate and specific instructions, and the latter taken the trouble to determine correctly what kind of battery it was, it was unlikely that the battery would have failed. What was more, correct instructions would doubtless have saved a lot of other customers' batteries from the same fate.

Accordingly, I rang the agents' service department again and, for a start, acquainted them with my findings concerning the number of cells and what this meant in terms of battery type. As I half expected, this proved to be something of a bombshell. On what, I was asked, did I base my statement that it would not be possible to get six volts from three nickel-cadmium cells?

When I replied that it was because a nickel-cadmium battery generated only 1.25 volts per cell, this not only caused considerable surprise but prompted the question as to whether I was referring to a primary or secondary cell. Whereupon I took the opportunity to point out that a nickel-cadmium cell was a secondary cell, and that there was no such thing as nickel-cadmium primary cell.

It was a trump card. Not only was it an irrefutable argument in itself, but it also made very obvious the service department's almost complete ignorance of batteries. I lost no time in following up my advantage with my claim that both the manufacturers and the local agents were partly to blame for the battery's failure, and that I felt that they should at least make some adjustment to the price of a new battery.

I must say I was given a good hearing, and the upshot of it all was that, although nothing could be done at the service department level, I was promised that the matter would be put to the appropriate departmental head for his consideration. and, after all, that was about as much as anyone could expect at such a stage of negotiations.

The next event in the story came as rather a surprise. It was a phone call from the service department a couple of days later, partly to check a few details about the age of the battery etc., but also to tell me that, following my submissions regarding the nature of the battery, they had cut an old one apart in an effort to verify this. As a result they were now satisfied in their own minds that the battery was of the lead-acid type.

They went on to say, by way of explanation, that they now realised that they had been misled by the manufacturers, perhaps by accident due to language difficulties, and they were taking the matter up with them immediately. In the meantime, the rest of my claim was still being considered.

Well, that was something I had achieved, anyway.

In fact, I felt I had done myself a good turn as well. For one thing, I had been forced to brush up my own knowledge of batteries and, for another, it had suggested a possible explanation for vague rumours I had heard on a number of previous occasions; rumours of nickel-cadmium batteries that had failed after only a few months use, particularly when left lying idle between jobs. It now seemed pretty obvious that there was considerable confusion as to just what was and was not a nickel-cadmium battery.

In fact, I still felt that a nickel-cadmium battery would have a number of advantages in this application, and began making inquiries as to what types were available which would suit this machine.

Phone calls to the local battery companies produced a lot of useful advice and a stack of data sheets covering everything from electrical specifications to type numbers, dimensions and prices. All I had to do was make a choice.

However, before I could spend very much time sorting all this out, the tape recorder agents came good with a replacement battery. And, as my friend was due off on another of his country jaunts, we decided to leave any further decisions until he returned.

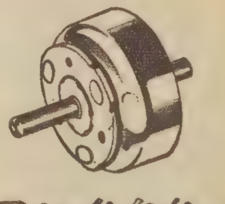
Which was a little frustrating, but at least I have the satisfaction of believing that I contributed something towards having the battery replaced.

And I've learnt something about batteries, too.

Compact Solutions with Ledex . . .

LEDEX ROTARY SOLENOIDS

Frictionless conversion of linear to rotary movement based on the inclined ball race principle. The designer's ideal solution where high torque, low bulk/power ratio, snap-action are required and dependable functioning is of vital importance.



LEDEX CIRCUIT SELECTORS

Combination of a Ledex rotary solenoid with an array of 8, 10, 12, 18, 20 or 24 position Oak-type switches for the remote control of predetermined circuit patterns.

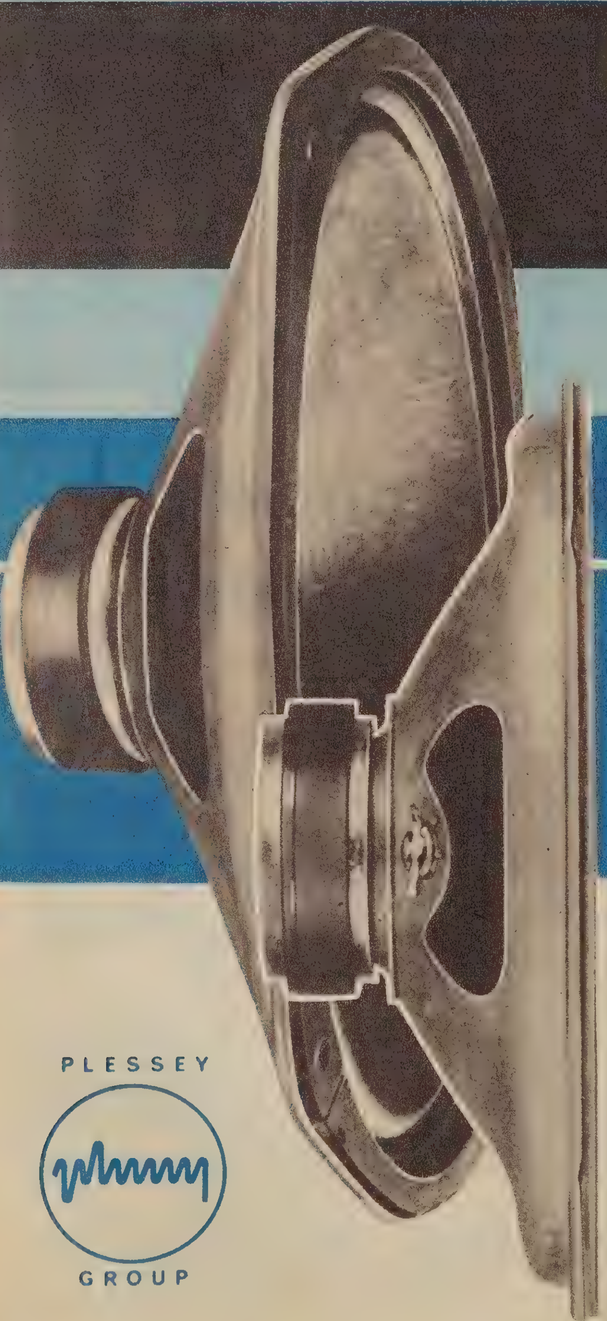
Other Ledex products are ready to work as compact solutions to your circuit switching applications. Write or phone for literature mentioning applications to . . .

MELBOURNE: Amalgamated Wireless (Australasia) Ltd., 167 Queen Street. Phone 67 9161. **HOBART:** Amalgamated Wireless (Australasia) Ltd., 123 Murray Street. Phone 3 3836. **LAUNCESTON.** Amalgamated Wireless (Australasia) Ltd., 80 Cameron Street. Phone 2 1804. **ADELAIDE:** Newton McLaren Ltd., Leigh Street. Phone 51 0111. **BRISBANE:** Chandlers Ltd., Albert and Charlotte Streets. Phone 31 0341. **PERTH:** Amalgamated Wireless (Australasia) Ltd., 335 William Street. Phone 28 3425.

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK STREET, SYDNEY. 2 0233

M488 MSP 11-63.

2 way in your CAR



ROLA

C9-6L
C7-5L

These new models C9-6L and C7-5L are the latest version of the two most widely used ROLA range of loudspeakers for car radio purposes. They incorporate the new Ferrite magnets, which besides greatly increasing the acoustic efficiency of the speakers also allow savings in the space required for their fitting — a very important consideration with car radio installations. Their rugged construction enables them to withstand the severe environmental conditions including wide temperature variations and mechanical shock to which they may be subjected. Of equal importance is the fact that they will fit practically all makes of cars.

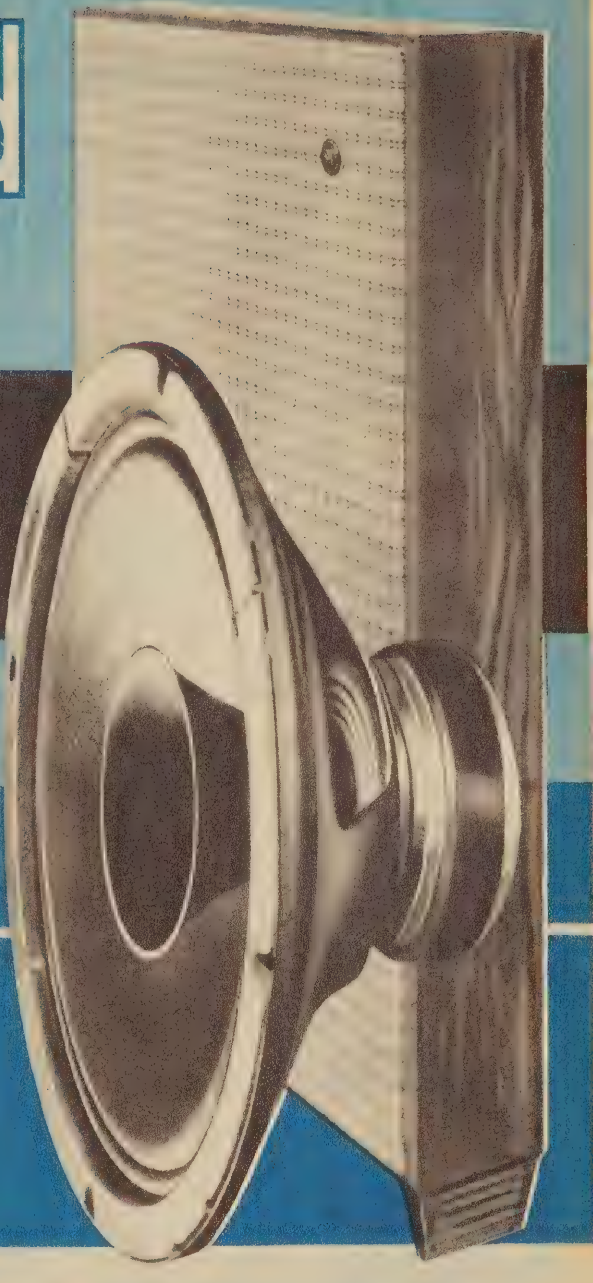
PLESSEY
GROUP

sound

in your HOME

ROLA

STEREO C8MX



Seldom has so much performance been packed into a small loudspeaker as that found in the new ROLA C8MX which has been designed particularly for stereo.

Its Frequency Response is within ± 6db from 40 to 12,000 c.p.s. Its Peak Power Handling Capacity is 16 watts. The efficient Ferrite magnetic system and a thoroughly engineered diaphragm design ensure both high acoustic efficiency and the excellent transient response which is the hallmark of a top-quality, wide-range loudspeaker.

The only thing "low" about the C8MX is its price.

The "Slimline" Enclosure

The ROLA designed "Slimline" enclosure has been developed specially for use with the C8MX and for application in the average home where living space is usually at a premium.
Its dimensions are 26" high, 18" wide and 6⅜" deep. (Note the front to back depth.)
A brochure containing full constructional details of the "Slimline" enclosure — which is simple and inexpensive to build — can be obtained from our Distributors or direct from our Melbourne and Sydney offices.

A Division Of The

Plessey Components Group

ROLA SPECIAL PRODUCTS PTY. LTD.

THE BOULEVARD, RICHMOND, E.1, VICTORIA. N.S.W. OFFICE: CALTEX HOUSE, KENT STREET, SYDNEY.

Homecrafts PTY LTD

AUSTRALIA'S LARGEST Radio, Television and Hobbies SPECIALISTS

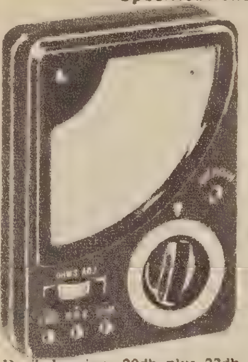
307 ELIZABETH STREET, MELBOURNE—60-1442.

★ We have everything for the Radio Hobbyist ★

MODEL 200H

20,000 Ohms per Volt DC 10,000 Ohms per Volt AC.

Specifications:



DC Volt: 0-5, 0-25, 0-50, 0-250, 0-500, 0-2.500.

AC Volt: 0-10, 0-50, 0-100, 0-500, 0-1,000

DC Current: 0-50. Microamps res 0-25, 0-250 Milliamperes.

Resistance: 0-60K Ohms, 0-6 Meg Ohms.

Capacity: 0-01-0.3mfd (at AC 5 volt 0.0001-01mfd at AC 250 Volt).

Decibel: minus 20db plus 22db.
Output Range: 0-10, 0-50, 0-100, 0-500, 0-1,000
Battery used: UM-3-1, 1 piece.
Dimensions: 3¼in x 4½in x 1⅛in.
Complete with internal battery, testing leads and prods.

PRICE: £5/10/-
Including Sales Tax
Plus Postage 3/6.

TRANSISTORISED CALLING & TALKBACK SYSTEMS

BATTERY OPERATED

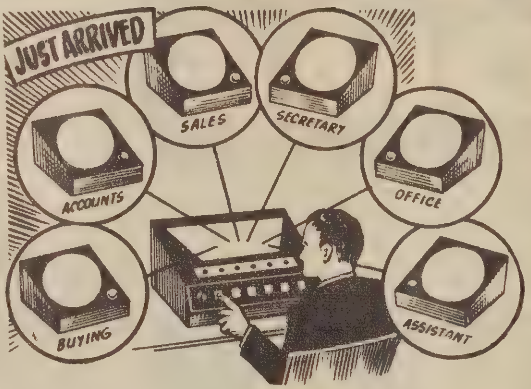


TABLE OR WALL MOUNTING

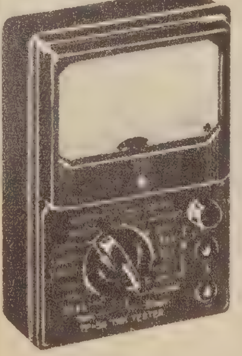
2 Station 1 Master 1 Sub-station 1 x 9V Batts., £7/17/6.
3 Station 1 Master 2 Sub-stations 4 x 1½V Batts., from £9.
4 Station 1 Master 3 Sub-stations 6 x 1½V Batts., from £12.
5 Station 1 Master 4 Sub-stations 6 x 1½V Batts., £22/7/9.
7 Station 1 Master 6 Sub-stations 6 x 1½V Batts., £27.

Plus Postage.

MODEL TP-5S

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

Specifications:



DC Voltages: 0-10-50-250-500-1,000 V (20,000 Ohms/V).
AC Voltages: 0-10-50-250-500-1,000 V (10,000 Ohms V).
DC Current: 0-50uA, 0-5-50-500mA.
Resistance: 0-10K, 0-100K, 0-1 Meg, 0-10-Meg. (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale.)
Capacitance: 0.0001uF-0.005-uF, 005uF-1uF
Decibels: minus 20db to plus 36db in 2 ranges.
Dimensions: 3½in x 5¼in x 1⅜in.
Weight: 15oz approx.
Complete with internal battery, testing leads with prods.

PRICE: £9
including Sales Tax.
Plus Postage 3/6.

Capacitor Substitution Box, 1000 VW 31/-
Resistor Substitution Box, 1 Watt, Plus Post. 2/-. 33/9

TRANSISTOR AERIALS

4in extends to 27in	15/
5in extends to 39in	17/
6in extends to 43in	14/
6in extends to 32in	10/
6in extends to 28in	9/6
7in extends to 39in	16/
9in extends to 39in	14/
10in extends to 39in	9/6

Plus postage 1/6.

LMI Crystal Mic. with 3.5mm plug. 10/. Post free.

Crystal and Magnetic Earphones, 2.5mm plug, 5/. Post free.

Trans. Pri. 220, 240, 250, Sec. 218V Doubler at 270mA, 6.3V at 8 amps. 25/. Plus postage 10/.

TV REMOTE SPEAKER CONTROL 39/6

has inputs for earphones and one speaker with volume control. Post 2/6

SYNCHROTAPE

100ft x 2¼in	4/6. Post 1/
300ft x 2¼in	12/. Post 1/
1200ft x 5¾in	25/. Post 1/6
1800ft x 7in	39/6. Post 2/6

Trans. Pri. 200, 220, 250. Sec. 275-275 at 80mA. 6.3V at 5A. 25/. Plus postage 10/.

Slide Rule Calculators, add, subtract, etc. to six figures. 6/6 ea. Post free.

Spiral indoor TV Antenna, 19/6. Plus postage 5/.

3AG Fuses 1 amp. 1/ pkt. of 5.
3AG Fuses 5 amps. 1/6 pkt. of 5.
3AG Fuses 10 amps. 1/6 pkt. of 5.

CRYSTAL SET BUILDERS

Coils	6/-
Diodes	3/-
Headphones	25/-
Tuning Conds.	16/6
Terms.	1/- ea.

1 Trans. Amplifier for crystal set circuit supplied,

Only 19/6
Plus Postage 2/6.

307 ELIZABETH STREET, MELBOURNE Phone 60-1442

The ABC-Four

This month the ABC-Three has grown up and, with a few modest changes, becomes the ABC-Four with increased sensitivity and capable of reproducing mono records.

By Keith Woodward

Layout for the ABC-Four can be similar to that for the ABC-Three. The new detector/pre-amplifier is at the front of the chassis.

While the ABC-Three gave good performance on local broadcast stations and the stronger short-wave stations, we noticed a tendency to run out of volume control for good loudspeaker listening on the weaker stations. This indicated that an audio preamplifier stage between the regenerative detector and the output amplifier would be desirable.

And having decided to provide an additional stage we felt we should make the most of it by providing some facility for plugging in a pickup for mono record reproduction. This was done with a jack on the rear apron of the chassis. When a pickup is plugged into this jack it not only connects to the pre-amplifier input but automatically disconnects the output of the regenerative detector from the audio stages.

The sensitivity of the pickup circuit is sufficient for use with most crystal and ceramic type pickups as fitted to the majority of popular turntable/pickup combinations. The result is a simple but effective record player, plus an all band receiver having quite good sensitivity.

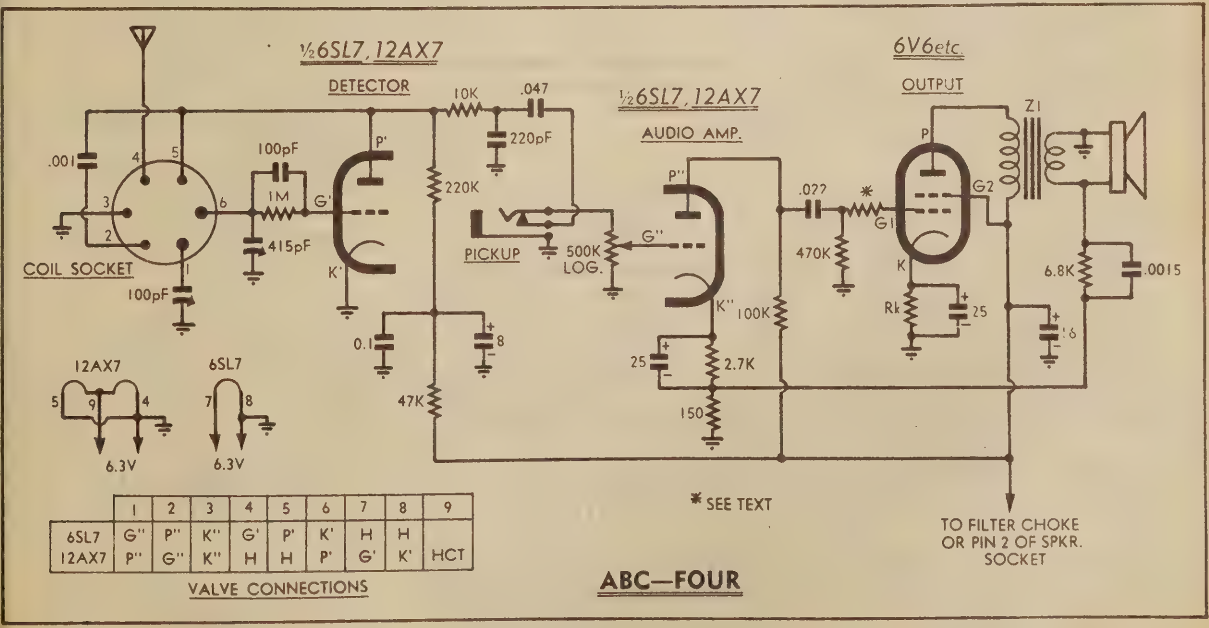
As we wished to keep the ABC-Four relatively simple we selected a twin triode valve to replace the original pentode regenerative detector. The first triode is now used for the regenerative detector and the second triode for the audio pre-amplifier. There are two valves particularly suitable for this role, the 6SL7 octal based valve and the 12AX7, a miniature nine-pin valve.

The 6SL7 was commonly available from disposal sources and may still be available in small quantities. If it is necessary to purchase a new valve for this project it will be found that the 12AX7 is much cheaper than the 6SL7. With either of these two valves the audio gain is excellent, while the regenerative detector functions quite smoothly.

There are other valves which could be used in this circuit such as 6SN7, 12AU7 and 12AT7. However, these valves, which may be used with the components listed in the circuit, do not exhibit the high gain of the previously mentioned types.

At this point we could have sat back and been quite pleased with the improvement obtained with our modifications. However, being audio-philes from way back, the urge to improve the audio reproduction, especially for recorded music, was irresistible. With the 6SL7 or 12AX7 valve we found that we had some audio gain to spare and experiments were carried out with negative feedback from the voice coil winding.

The term negative feedback refers to the sampling of voltage, or current, from the output of an amplifier, which is then fed back to the input circuit in such a manner (negative phase) as to oppose the incoming signal. Such an arrangement effectively reduces the gain of the amplifier and, at first glance, this would appear to be a serious disadvantage.



	1	2	3	4	5	6	7	8	9
6SL7	G''	P''	K''	G'	P'	K'	H	H	
12AX7	P''	G''	K''	H	H	P'	G'	K'	HCT

VALVE CONNECTIONS

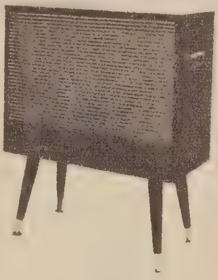
ABC—FOUR

Main feature of new circuit is the use of a twin triode in place of the original pentode. For power supply details refer to last month's circuit.

T.O.S.C.A. ELECTRONIC SALES

180 LYONS ROAD, DRUMMOYNE
81-3443 81-1810

Speaker Vented Enclosure SPECIAL Highly polished with side handles 20"x24"



Terrific performer.
In wal., maple, ros.
with 12WR and tweeter,
$36.00.
With 6WR and tweeter,
$34.00.
Add $1.00 N.S.W.; $4.00 Vic., Qld.;
W.A., N.T., Tas., $8.00.

MSP 110 deg.

(42513)
Suits A.W.A., H.M.V., Admiral.
$5.00.
Add N.S.W. 30c; Vic., Qld., 40c;
W.A., Tas., 60c.

Rola 110 deg.

TV 1702 eq. to 1811.
Suit Ecko., Strom. Carlson.
$6.00
N.S.W. 30c; Vic. 40c, W.A. 60c.

Sockets for valves

Shielded—9-pin, 7-pin.
$1.00 for 10.
Add 20c post.
Also not shielded same price.

ROLA 90 deg.

TV 1300.
Suit some 90 deg. $7.00
N.S.W. 30c; Vic. 40c; W.A. 60c.

ROLA 114 deg.

TV1970 (equiv.)
Suit latest 23"
$9.00.
N.S.W. 30c, Vic. 40c, W.A. 60c.

4" Tweeter Special

3.7 4k to 15k $1.00 Add 30c.

Rolo Reverberation Unit

Add 30c. Few left. $18.00.

LATEST AUTOCHANGER

4-speed Stereo. $20.00.
N.S.W. $1.70; Vic., Qld. $2.20.

Power Transformer

90mA, suite Stereo. Single ended.
240v to 2 x 215v and 6.3v.
$3.50. 40c post.

PHILIPS T.V. TUNER

7580 3001
$10.00
Tested. Few left.
N.S.W. $1.00; Vic., Qld. $1.50.

YOKES SPECIAL ROLA 90 deg.

ROLA 90 TV 911
Suit most 90 deg.
$7.00
N.S.W. 30c; Vic. 40c; W.A. 60c.

Double Potentiometer

with Switch.
2 x 2 Meg. tap at 150k.
$1.00
Add 20c post.

12" all transistor TV PRINCESS the best fringe performer

12v battery or 240v.
$300.00
Discount given.
Add $2.00 N.S.W.; $4.00 Qld., Vic.;
$10.00 W.A., Tas.
WE STOCK ALL SPARES FOR THE PRINCESS.

Resistors special

1 Watt	2 Watts
470 Ohms	270 Ohms
1 k/ohm	560 Ohms
2.7 k/ohm	2.7 k/ohms
12 k/ohm	4.7 k/ohms
24 k/ohm	5.6 k/ohms
47 k/ohm	
20c a doz.	40c a doz.

Only dozen lots.
Post paid.

NEW VALVES

1X2 b	$1.20
6CQ6 (6AM6)	$0.60
6EM5	$1.00
6CD6	$3.00
6AL5	$0.80
6AX4	$1.00
12AX7	$1.20

Newmarket Transistors

Amplifiers stocked.

PC2	$7.00
PC3-4	$7.00
PC5	$16.00
PC 7	$9.00

Please add post.
PC9 pre amp. $6.40
Latest release.

For builder of remote controls

12 position switch, relay operated. Ideal for TV or any remote operation.
$1.00
Add 20c.

Audio Out. Tranny

16k to 3 Ohms 50c
20c post.

9-PIN PRINTED BOARD SOCKETS.
$1.00 for 10.

Handy Size Chassis 11" x 3"

Complete with 4 valves, sockets, tag strips (6). Rotary 12 pos. Relay on/off. Relay with bottom cover.
Yours for $2.00. Add 30c post.

Home builder SPECIAL highly polished complete with legs and side handles as in photo.

In walnut, rosewood, maple.
packed in carton.
Add post N.S.W. $1.00; Qld. Vic.
$4.00; Tas., N.T., W.A., $8.00.
Price $10.00

Mica condenser

10pf	10c
47pf	15c
100pf	15c
390pf	20c
680pf	20c
.001mf	15c
.0022	25c
.0039	20c
.005	20c

$1.50 a doz.

Remote control

motor 24V ac.
Ideal for TV and hobbies. Complete with gearbox in original condition.
$1.00
Add 20c.

20 W transformer

240v to 117v.
Ideal for small conversion.
$1.00
Add 20c.

Electrolytic Special

24mf, 450v/w	60c
50mf plus 8 mf plus 24mf	80c
24mf plus 8 mf plus 50mf 20v,	80c

Add 20c post.

Transistor Driver Tranny

From OC71 to 2x OC74
$1.50.
Add 20c.

Ceramic condenser

33pf	10c/10
6.8	10c/10
50pf	20c/10
33pf	15c/10

All in 10 lots.

2 pin speaker plug

and Sockets.
With polarity prov. 10c.

T.V. Power Transformer

200 mA.
2 x 215v, 2 x 6.3v.
$8.00
Add $1.00 N.S.W.; $2.00 Vic., etc.

However, while no one will pretend that loss of gain is ever an advantage in itself, there are a number of other very worthwhile advantages resulting from the arrangement which more than compensate for this loss. The main ones are: reduced harmonic distortion, smoother frequency response, and improved loudspeaker damping; all of which are important in good quality reproduction.

With a sample of the output voltage taken from the transformer voice coil and fed back to the pre-amplifier cathode we were able to achieve a relatively smooth frequency response from about 100cps to above 10KC.

A close inspection of the feedback loop from the voice coil will reveal that the resistor in the circuit is parallelled by a capacitor. At the higher audio frequencies it is not uncommon to find a significant change in signal phase. This capacitor in the feedback loop advances the phase of the feedback at the higher frequencies compensating for the above effect.

This change of phase can result in the amplifier becoming marginally or, in extreme cases, totally unstable and go into oscillation at high audio or supersonic frequencies. Even when the condition is only marginal it is undesirable, because the amplifier will try to oscillate whenever an abrupt signal is encountered, giving rise to a condition known as "ringing." This is highly undesirable if clean reproduction of sharp "transients" is desired.

As the output transformer in your ABC-Four may vary considerably from the original it would be impossible to quote the optimum values for the negative feedback loop components. However, for an output impedance of 15 ohms the values specified would be near enough to give a decided improvement over the circuit without feedback.

If an output transformer with a 3.5 ohm secondary is used then the feedback resistor can be reduced to 3.3K and the capacitor may be increased to approximately .0033uF. An output impedance of 2 ohms will require a resistor of 2.2K and a capacitor of approximately .0047uF. The capacitor figures quoted are approximate. It is impossible to quote exact figures owing to the number of variables in the output transformer. However, for most practical purposes these values should give good results. The negative feedback is an optional extra and should it not be required it is only necessary to omit the feedback resistor and capacitor as well as the 150 ohm resistor. The cathode resistor and bypass capacitor would then connect to chassis.

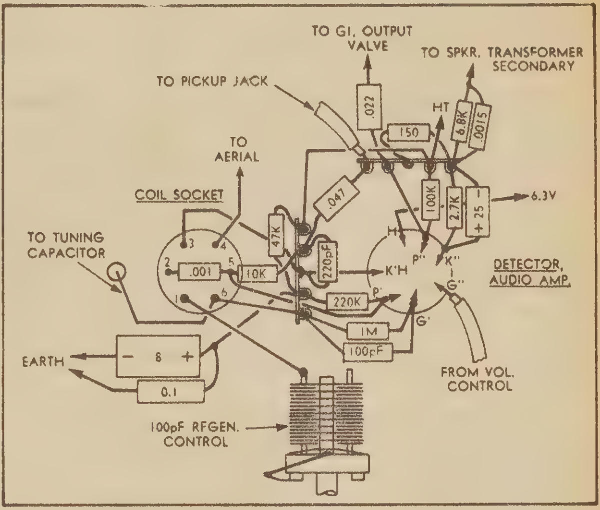
As it is essential to achieve correct phasing for the negative feedback system (so that it really is negative and not positive), and there is no easy way to nominate which way round the speaker transformer secondary should be connected, this will have to be determined by trial and error.

Temporarily connect one side of the voice coil to chassis and the other side to the feedback resistor/capacitor combination and arrange matters so that the latter may be connected briefly to the second triode cathode circuit (as shown in the circuit) while the amplifier is playing. If the phase is correct, this will result in a drop in output level and the connections may be made permanent. If it is incorrect, the gain will rise or the amplifier will burst into violent oscillation. In this case reverse the feedback connections to the voice coil.

Another circuit point to be considered is the HT supply to the plate of the detector valve, and which has been modified from our original design.

When the output amplifier is functioning, variations in current drawn by it from the power supply will lead to variations in high tension voltage unless the supply is extremely well regulated. These variations in power supply voltage appear at the plate circuit of the regenerative detector, are treated as signals by the pre-amplifier stage and eventually reach the output stage grid. This causes a further change in the current drawn by the output stage and the effect multiplies until the receiver bursts into oscillation.

This wiring diagram refers to the twin triode socket. Layout is not critical, but this arrangement will probably suit most cases.



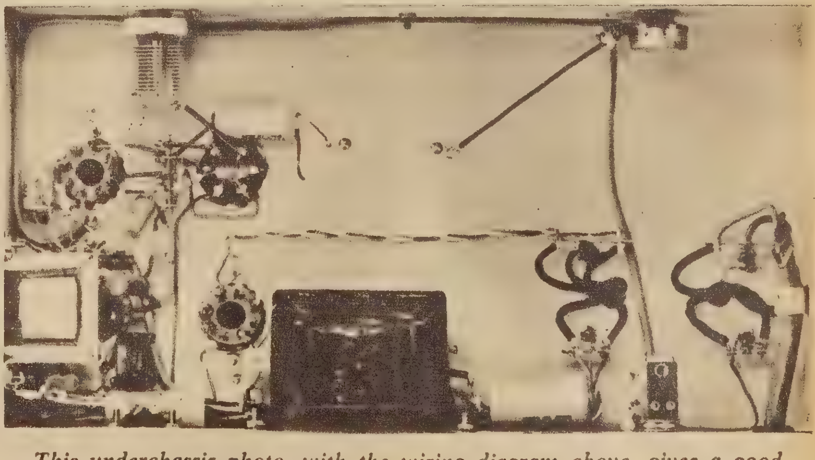
This fault may be cured by using very large filtering capacitors in the output of the power supply, but this is not very economical. As the feedback is caused by the variations appearing at the regenerative detector plate, it is easier to filter these alone by what is known as a decoupling network. This consists of a resistor and a small electrolytic capacitor. In our case this is the 47K resistor and 8uF capacitor shown in the circuit diagram.

Owing to the additional sensitivity of the ABC-Four it is a wise precaution to run all the leads associated with the volume control and pickup jack in shielded lead. This reduces the chances of stray hum pickup and unwanted positive feedback.

Very few extra components are required to change the ABC-Three to the ABC-Four. The main component is the twin-triode valve and possibly a matching socket. If the pickup facility is required a breaking circuit jack and matching plug will be required. The negative feedback components will have to be selected as mentioned earlier in the text. The resistor in this section is a ½-watt type, while the parallel capacitor may be either paper or plastic with a rating of 125 volts or higher.

The other components consist of the following half-watt resistors plus three capacitors: 1 150 ohm, 1 2.7K, 1 47K, 1 100K and 1 470K. The three capacitors are a paper or plastic .022uF a pigtail electrolytic with a value of 25uF and a voltage rating of 12 volts and another pigtail electrolytic capacitor with a value of 8uF, 350 volts.

If the receiver is to be built from scratch we suggest that you obtain a copy of the original article describing the ABC-Three which gives all coil details together with a general discussion of the selection of components. ▪



This underchassis photo, with the wiring diagram above, gives a good idea of the overall layout. However, this is not particularly critical.

"BREADBOARD" HOOK-UPS
—1966 STYLE

Those experimenters who feel that the advent of the mass produced printed wiring board has robbed the home builder of his individuality, will welcome the latest innovation in this field. Called Veroboard, it is a pre-punched, pre-etched board with a uniform hole and wiring pattern easily adaptable to almost any circuit configuration. In this article we show how it can be used in a number of interesting beginner projects.

By Philip Watson and Michael Meechan

The physical form of electronic devices has undergone quite a revolution in the past ten years or so. Not so long ago the popular and almost only concept of radio and TV sets, amplifiers, and industrial electronic gear, was a metal chassis on which were directly mounted the major components; power transformer, tuning capacitor, valve sockets, etc. Minor components were supported either between the major ones or on terminal lugs mounted on insulated strips. Additional interconnection was by individual lengths of insulated hookup wire.

The first hint of a change came with the development of the printed wiring board; a sheet of copper clad insulating material on which was etched, by a photo-litho process, a complete wiring pattern in the copper film. The new concept offered many advantages; low cost for large quantities, uniform quality free from wiring errors and, where other components permitted, compact construction.

This last possibility did not make much impact initially, except in special applications, for we were still in the days of the valve and the valve exclusively. Nevertheless, components specially designed for printed wiring began to appear, including valve sockets for soldering directly into the boards, and "single ended" minor components with both pigtails at one end to facilitate the new form of mounting.

Then, with the introduction of the transistor, and the rapid development of miniature components to go with it, the revolution was almost complete. For miniature equipment at least, the chassis virtually ceased to be, being replaced by what really amounted to a glorified terminal strip, albeit a highly specialised one.

Which was fine for the manufacturer, but rather left the design engineer, experimenter, home constructor, or anyone else who wanted to make "one off," out in the cold. Printed wiring was ideally suited to mass production, once the design had been finalised, but offered no equivalent in a hand made form, such as had been possible with the old style construction.

Anyone who wanted "one off," therefore, had either to revert to the older form of construction, with all its disadvantages, or make what use he could of such printed wiring patterns as were already in existance. The latter was useful where only the value or type of component was to be changed within the same circuit configuration, but obviously was of little use beyond this.

There have been several approaches to this problem. One was to simplify the printed board process to the point where it became practical to make "one off," usually by hand painting the pattern on the copper with a suitable resist paint, then etching in a simple bath. While useful up to a point, it is better suited to second stage working, such as copying a pattern already worked out, but for which no commercial board is available. It also suffers the disadvantage that, without some means of image reduction, it is difficult to prepare a complex pattern directly on the copper.

A better approach is the system using insulating board similar to that used for printed wiring, carrying no copper pattern, but pre-punched with rows of holes, rather like the arrangement used in a Meccano set. Any hole may be made into a terminal point by simply inserting an eyelet and crimping it in place, these points then being joined by short lengths of tinned copper wire.

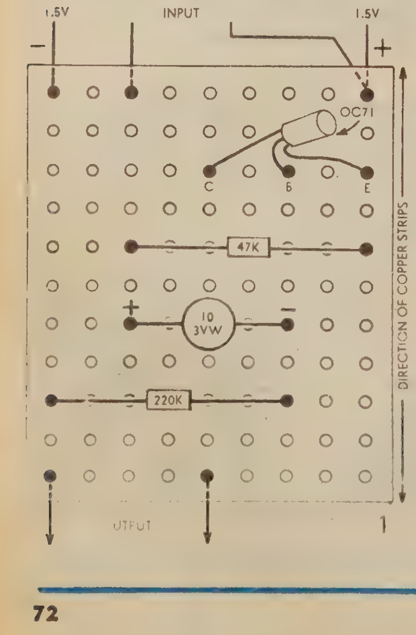
In practice, the idea works very well and, by deliberately arranging the wiring so that no leads cross, the first step is taken toward a layout suitable for a conventional printed board, should this be the ultimate aim. In any case, it puts the individual worker on very nearly equal terms with mass production techniques.

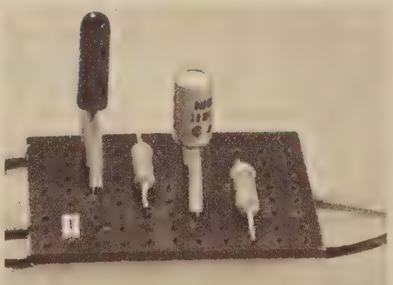
More recently, another system has appeared on the market, and this too, appears to offer the individual a convenient means of "one off" production. Like the previous system it uses a sheet of insulating material carrying a pattern of holes—there are several different hole centre dimensions available—but goes one step further in that it is already equipped with a copper pattern on one side, consisting of parallel strips running along the adjacent rows of holes.

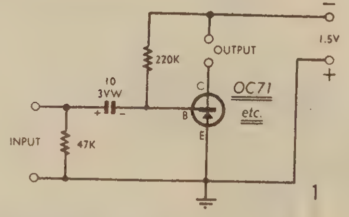
Thus all the holes in each row represent a common circuit, running, if necessary, the full length of the board. However, it is quite a simple matter to break the copper strip at as many points a may be desired, making it into a numbe of short runs, each connecting togethe as many holes as required. A special too is available for cutting the copper strip but a 1/8in drill makes a very good sub stitute for the home constructor.

A variety of other accessories ar available, including terminal pins, edg

SINGLE-STAGE AMPLIFIER FOR CRYSTAL SETS







1 OC41 transistor.
1 47K ½ watt resistor.
1 220K ½ watt resistor.
1 10uF 3 volts working electrolytic capacitor.
1 Piece sample Veroboard 1¾in x 1⅜ in, 1 1.5V battery, signal and battery wires, sleeving.

connectors, Varicon contacts, etc., and these would particularly interest the advanced worker. Initially, however, the home constructor will find that he can tackle a wide range of construction projects with nothing more than a piece of board and the ordinary workshop tools.

To help introduce this material to the Australian market, the local agents, E.M.I. Electronics, are arranging to distribute a quantity of free samples, measuring approximately 1 3/8in x 1 5/8in. To obtain one of these it is only necessary to send a stamped self-addressed envolope to the above company, and full details are contained in the company's advertisement elsewhere in this issue.

Encouraged by this gesture, we have prepared a number of simple projects suitable for this form of construction and this size board. They represent an excellent introduction to practical construction and the operation of simple circuits, as well as being projects which should be useful in their own right.

1—Single-Stage Amplifier for Crystal Sets

This one stage audio amplifier should be of particular interest to those who have a simple crystal set and wish to hear either local or distant stations with increased volumes in their headphones.

Firstly, let us consider the advantage of a crystal set followed by an audio stage. The first, and most obvious, is the amplification of signals to a more comfortable listening level. The second, although not so obvious, is the improvement in selectivity which may be obtained by reducing the aerial coupling, which is achieved by tapping the aerial further toward the earthy end of the coil.

This reduces the load on the tuning coil, thus enabling it to achieve a higher "Q," the major factor governing selectivity. Since the headphones also load the coil, a further improvement should result by reason of the higher input impedance of the amplifier, compared with most headphones, particularly the low impedance types. If the gain allows tapping further down the coil, we will be that much better off again.

At this point it may be useful to define what is meant by high and low impedance headphones. Those referred to as "high impedance" types have a DC resistance of about 2,000 to 4,000 ohms, and an impedance of about 7,000 to 20,000 ohms, depending on construction. The so-called "low impedance" headphones are the most common types available from disposal dealers having a DC resistance of a little more than 100 ohms and an impedance of several hundred ohms.

This circuit is about the simplest amplier possible, in which the transistor has a grounded emitter and the collector voltage is supplied from a single pencil torch cell of 1.5V. Bias current is provided by the 220K ohm forward bias resistor and the signal is fed to the base via a 10uF low voltage type electrolytic capacitor. The headphones are connected in series with the transistor collector and negative 1.5V.

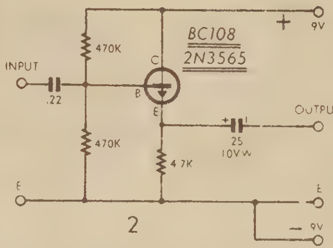
A marked improvement in level may be obtained by reducing the 220K resistor to about 68K when using low impedance headphones.

The transistor used is an OC71 although it is likely that other suitable types may be on hand. A few typical types are as follows: 0C70, TS1, TS2, 7S3, SFT152, SFT153, SFT1561, 2N406, etc.

Construction of this amplifier on a sample piece of Veroboard is very simple and straightforward, the photograph and drawings providing all the information required regarding component location and solder points.

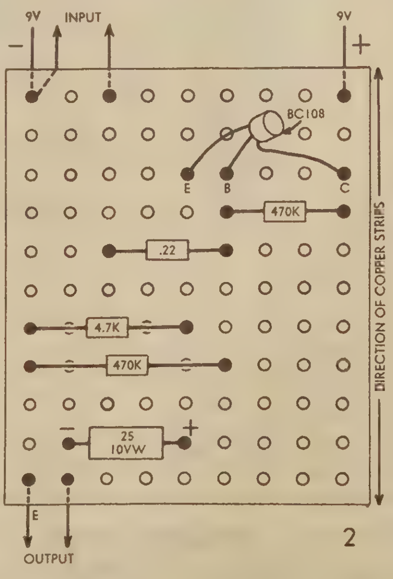
2—An Impedance—Matching Stage

Our next project is a one transistor impedance matching device which has a number of useful applications in audio circuitry.



2

1 BC108 transistor.
2 470K ½ watt resistors.
1 4.7K ½ watt resistor.
1 .22uF capacitor.
1 25uF 10 volts working electrolytic capacitor.
1 piece sample Veroboard 1¾in x 1-3/8 in, 1 9V battery, signal and battery wire, sleeving.



2

The matching of high impedance sources to the input of valve circuits is reasonably easy to achieve by design, and in fact, input impedances up to the order of 10M are possible as long as the valve operating conditions are carefully watched. In the case of transistors, however, it is not so easy, and high input impedances are not a natural characteristic. Therefore, it is not so easy to match high input impedance sources to transistorised circuits as it is to valve circuits.

To overcome this problem an impedance matching device is required. This is where our little unit finds its use, for it is capable of matching a high source impedance to a low input impedance. This does not imply that it can only be used for matching into transistorised circuits, because not all valve circuits have high input impedances, and it can be used equally well for matching into low impedance input valve circuits.

The circuit, using a BC108, or 2N8565, NPN transistor, is connected as a common collector, emitter follower, and operates from a 9V supply. The voltage gain of this device is less than unity, and therefore, does not amplify. For this reason, there must be a sufficiently high level of signal available from the source being matched to ignore the lack of gain of the circuit. The signal is applied to the base via a .22uF capacitor, and the output extracted across the 4.7K emitter resistor via a 25uF capacitor.

The input impedance of this circuit is about 220K. Frequency response is better than plus or minus 2dB between 20cps and 20KC. With a 10K load in the output, a signal input level of 1.5V can be handled without the circuit clipping, this effect actually occurring at approximately 1.7V. With the output load reduced to 1K, clipping occurs at an input level of 350mV.

This project is not at all difficult to build, and, as with all the others in this series, should prove interesting to both beginners and experienced constructors alike. The photograph gives a general idea of the layout, whilst the drawings give precise details of both the component layout and underside copper strip soldering points. One check that the circuit is functioning correctly is to measure the total battery drain, which should be approximately 0.9mA.

3—Two-Stage Amplifier with RF Probe

This project, a two stage audio amplifier with volume control and supply switch, is a "big brother" to the one stage audio amplifier for crystal sets described elsewhere in this series. It is suitable for a wider range of applications, as we shall see.

One use for this amplifier is that of tracing signals in audio circuits, the input of the amplifier being connected across signal points in the circuit being examined. This enables the user to determine the presence, or otherwise, of signals at any given point.

For example let us assume that it is desired to locate a fault in an audio amplifier. The input of the test audio amplifier can be connected to the input of the first stage of the equipment being tested, where a signal should be heard if all is in order. This being so, the signal tracer can then be connected to the input of the second stage, and so on towards

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

PORTABLE TRANSISTOR CHECKER

MODEL TRC-101

A good quality Battery Operated Instrument. Tests all types of Transistors, including Power Transistors, Diodes and Rectifiers. Clearly marked direct reading scale. Measurements 7in x 4¾in.

$30.00 plus 12½ p.c. S. Tax.

SPECIALS

1—PIEZO Reverberation Units, incorporating spring and coil, two are available:
RE4 two-spring, with 100 ohms input, 50K ohm output. **Price $5.38 (53/9)**
RE6 one-spring, with 16 ohms input, 10K ohm output. **Price $3.25 (32/6)**

2—C.O. Contact Cleaner in handy 6oz Pressure Pack can. Split-second microscopic cleaning action, leaving no residue. Ideal for use on all electronic, telephone and electrical equipment which becomes inaccurate or inoperative due to presence of dirt, grease or other foreign matter. A must for the TV technician. **Price $3.25 (32/6)**

3—C.R.C. Lectra-Shield in handy 16oz Pressure Pack can. Provides an effective, low cost, long lasting, easily removed barrier to moisture and oxygen, the primary causes of electrical failure and metal corrosion. For use on all electronic and electrical equipment. Lasts from one to five years, depending on application. **Price $3.38 (33/9)**

4—Lapel Crystal Microphones, chrome plated finish, complete with cord and miniature phone plug. Suitable for transistor tape recorders, etc. **Price $1.25 (12/6)**

5—Selenium Rectifiers. Ideal for battery chargers, etc. Full wave bridge connected DC output, 12/15 volts.
5 amps $4.95 (49/6), 7½ amps $7.42 (74/3)

6—Battery Holders for transistor (Jap) portables. These hold four 915 or 1015 Penlite cells. **Price 68c (6/9) each**

7—Piezo Turnover Crystal Cartridge complete with two sapphire styli and carriage ready to assemble into arm universal or single-hole mounting. Excellent quality.
Mono Y99 $1.75 (17/6)
Stereo Y130 $2.95 (29/6)
Stereo Y110 $3.95 (39/6)

8—Stereo Pick-up Arm, complete with turnover crystal cartridge, two sapphire styli and arm rest. **Price $4.12 (41/3)**

9—Hi-Fire Transistorised Ignition Coils. Instant start, increased acceleration, more m.p.g. Doubles plug life. Contact points stay permanently tuned. 30,000 volts from cranking to 5,000 revs. Easy to convert. Only three wires, same as conventional coil.
Positive to earth $61.85 (£30/18/6)
Negative to earth $58.50 (£29/5/)

10—Sato Morse Code Key and Buzzer in separate units. Can be assembled for use as a practice set. Buzzer supply 1.5 volts obtained from a single torch cell. Key and buzzer. **Price $3 (30/)**

11—Sato Standard Phone Plug and Jack. Excellent quality. **Special 55c (5/6) pair**

12—Carbon Potentiometer 250K with single pole switch. Brand new and boxed. Reduced to clear at **Price 58c (5/9)**

Linmark stereo Amplifier

MODEL YA-130A

A high quality amplifier at a reasonable price. Specifications are as follows:

Output power, 7 watts per channel. Frequency Response, plus or minus 1 db., 40 to 20,000 c.p.s. Harmonic Distortion, less than 1%. Input for Full Output, 300 m V. Output Impedance, 4, 8 and 16 ohms each channel. Tone Control, more than 14 db at 10,000 c.p.s.

Valves used: 1, 12AX7; 2, 6BQ5; 1, 6CA4.

Power Supply: 220-240 volts A.C., 50 c.p.s.

Dimensions overall: 9¼ x 4½ x 7 inches.

Weight: 9lb.

This is a really good amplifier at a reasonable price of only **$42.90**

SPECIAL NOTICE

All parcels sent Registered Post unless otherwise stated. Postage or freight must be included with order.

Chieftain Transistorised Record Player

3 Speed . . . Battery operated from 4-950 torch cells . . . 4 transistors with turn-over crystal cartridge . . . Excellent tonal reproduction . . . Smart, modern, compact vinyl-steel plate cabinet in two tone colours . . . Lightweight, handy to carry . . . Ideal for the teenagers. **$35.70**

TRIO 9R-59 COMMUNICATIONS RECEIVER

FREQUENCY RANGE: 540-1605 K c/s. 1.6-4.8 M c/s, 4.8-14.5 M c/s, 10.5-30 M c/s.

BANDSPREAD: 3.5 M c/s, 7 M c/s, 14 M c/s, 21 M c/s, 28 M c/s.

SENSITIVITY: 10 UC (input at 10 M c/s). S/N ratio equals 20 db.

SELECTIVITY: Variable from —93 db to 60 db (Q-MULT in operation with plus or minus 10 KC detuning).

OUTPUT: 1.5 Watt.

POWER: 240 AC, 50 VA.

TUBE COMPLEMENT: 6BA6, RF AMP; 6BE6, MIXER; 6BE6, LOCAL OSC.; 2X6BA6, IF AMP; 6AV6, 2ND DET, AF AMP and ANL; 6AV6, Q'MULTIPLIER, BFO; 6AQ5, POWER OUTPUT; 5Y3, POWER RECTIFIER.

SPEAKER IMPEDANCE: 4 or 8 Ohms (Speaker not provided).

DIMENSIONS: Width 15 inches x height 7 inches x depth 10 inches.

WEIGHT: 20.5lbs.

AUX. CIRCUITS: Bandspread; Q-Multiplier; Automatic Noise Control.

AVC-MVC.

Phone Jack Plug.

PRICE **$139.00**

547 ELIZABETH STREET, MELBOURNE — Phone 30-0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

the loudspeaker until the signal cannot be heard. When this has been determined we know that the fault lies between that point and the last testing place where the signal was heard. A thorough examination of the circuit between these two points should reveal the faulty component.

It is also possible to trace distortion in audio equipment using this approach, the signal tracer indicating at which point in the circuit the distortion is occurring.

When the amplifier is to be used in this application an isolating capacitor of about .1uF, 400V, should be connected in series with the active input terminal (top of the 10K pot.). Additional isolation can be provided by adding a resistor in series with capacitor, say 10K or as much higher as can be tolerated without serious loss of gain.

The sensitivity of this amplifier is such that it may be connected directly to tape heads, microphones and pickups to check their outputs. However, there are no equalisation circuits in this amplifier and, where equalisation is necessary due to the recording characteristics of either tape or disc, or where mismatch between pickup or microphone and the amplifier input suppresses the bass response, the overall balance may sound "thin" or "tinny."

Most magnetic headphones can be used with this unit, including both low and high impedance types, although the low impedance types would be nearer a correct match for the output stage. Crystal earpieces are not suitable and should not be tried.

This circuit has been fully proven in earlier projects and uses an OC70 and OC74 combination of transistors. The input signal is developed across the 10K potentiometer which serves as an input level or volume control. It is then applied to the base of T1 via a 5uF capacitor, amplified, and then directly coupled to the base of T2. The further amplified signal is then used to drive a pair of headphones.

One of the problems of simple circuits of this kind is thermal stability. Transistors are noted for their sensitivity to changes in ambient temperature and their tendency to "thermal runaway." To compensate for this, most transistor stages involve resistor and/or thermistor networks so arranged that an increase in collector current is offset by an automatic decrease in the forward bias.

Our circuit uses direct coupling between the two stages, the first operating as a low level amplifier and the second as a power amplifier. By reason of the direct coupling the temperature coefficient of each transistor is made dependent on the other.

The forward bias on the base of T1 comes from the emitter of T2. Transistor T1 draws collector current through its 33K load and the same potential which exists at the collector is applied to the base of T2. The effective forward bias on T2 is the difference between this potential and the potential developed across its own 1.5K emitter resistor.

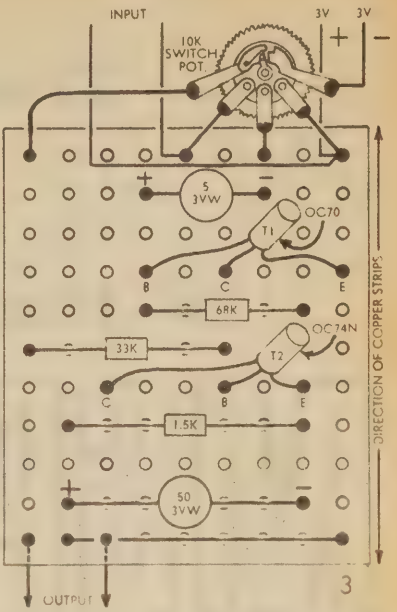
In this circuit, any increase in the average collector current of T2, due to temperature rise, will produce a corresponding increase in potential across the 1.5K emitter resistor. This will increase the negative bias at the base of T1 producing an increase in the collector current. And T2 base voltage shift towards, tending to offset the original. This decreases the voltage between T1 collector and chassis and, by reason of the direct coupling, also between T2 base and chassis. Thus the bias on T2 is reduced and the collector current reduced. However, it would require a much higher ambient temperature than normal before the power output was reduced by a significant amount.

TWO-STAGE AMPLIFIER WITH RF PROBE

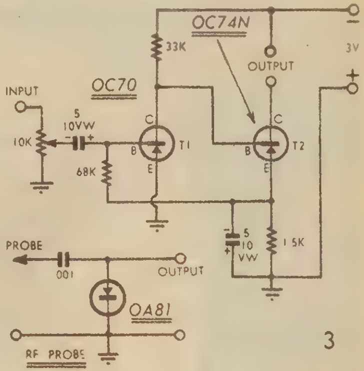
1 OC70 transistor.
1 OC74N transistor.
1 Miniature 10K switch potentiometer.
1 1.5K ½ watt resistor.
1 33K ½ watt resistor.
1 68K ½ watt resistor.
1 5uF 3 volts working electrolytic capacitor.
1 50uf 3 volts working electrolytic capacitor.
1 piece sample Veroboard 1¾in x 1-3/8 in, 2 1.5V pencil light batteries, signal and battery wires, sleeving.

RF PROBE

1 OA81 rectifier.
1 .001uF 350 volts working capacitor.
1 pen light torch or ball-point pen (see text), screened wire, earth lead wire and crocodile clip.



3



3

The temperature rise in T1 is not so important, since it is an amplifier rather than a power output stage, and operates under much less critical conditions.

As it stands, this circuit can only be used for tracing audio signals. In order to trace modulated RF signals it is necessary to preceed the amplifier with a detector or demodulator. Such a device is simplicity itself, and consists of only two components, as shown in the circuit diagram. The RF signal is applied across the OA81 diode via a 1,000pF capacitor, and, with the circuit connected to the amplifier, the 10K input potentiometer acts as the diode load. Such a piece of equipment is called an RF probe.

As our circuit contains only two components, it is possible to construct it in a number of ways as a small and handy item. Probably the most convenient method is to house the capacitor and diode in a hollow pen-like holder, such as the plastic case of a ball-point pen. Suitably cleaned, and with the components soldered to it, the metal part housing the actual ball-point becomes the probe tip with which to pick up signals whilst a flying lead may be taken away and connected to chassis, thus giving a compact and easy to handle unit. The

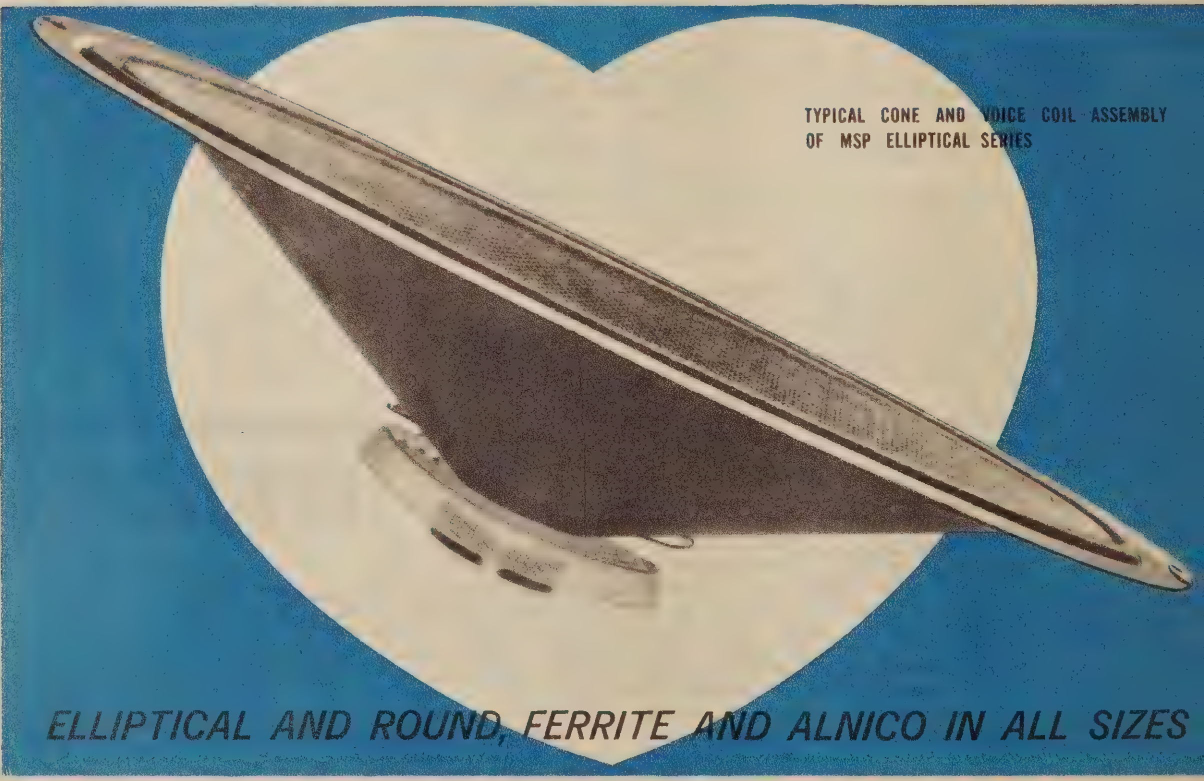
VEROBOARD

To obtain your free sample, send stamped self addressed envelope to:—*

**Veroboard, Electronics Div.,
E.M.I. (Aust.) Limited
P.O Box 352, HAYMARKET,
N.S.W.**

* This offer closes on the 8th April, 1966.

The CONE is the HEART of your MSP HI-FLUX SPEAKER



TYPICAL CONE AND VOICE COIL ASSEMBLY OF MSP ELLIPTICAL SERIES

ELLIPTICAL AND ROUND, FERRITE AND ALNICO IN ALL SIZES

Kid gloves are not good enough for the handling of this **key** component of every MSP Hi-Flux Speaker — from the moment the **cone** is formed it is treated with meticulous care as it proceeds through an exacting series of tests and inspections. But the greatest care of all begins at the design stage when the exact cone shape and rim configuration are determined. Then comes the choice and blending of fibrous pulps for the sound characteristics to be achieved — next to be decided is the most suitable beating cycle which will turn the mix into the exact form required — then follows the decisive cone forming operation — but perhaps enough has been said already to convince you that MSP speaker cone design and manufacturing techniques are important reasons why this range has become **first choice in Australia.**

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK STREET, SYDNEY – 2 0233

same idea could also be used with a pen light torch case.

The combination of RF probe and amplifier allows RF signals in radio receivers to be traced by merely connecting the probe between any desired point in the circuit, and chassis. In most cases it should be possible to trace the RF signal path for any dis-continuity up to the output of the converter. In fact, it is possible to detect strong local stations at the input of the converter.

As can be seen from the photograph, the components comprising the amplifier are easily accommodated on a piece of sample Veroboard. The drawings illustrate the layout used, and the soldered connections necessary to form the circuit in conjunction with the copper strips and components.

The circuit is connected to the negative supply of the battery via the switch on the potentiometer. The positive supply lead is taken straight to the board.

A rigid mounting for the potentiometer is achieved by soldering a piece of ½in long tinned copper wire to each of three tags, these extensions then being soldered into their respective holes on the board. The remainder of the construction is perfectly straightforward.

4—Audio—RF Multivibrator

In the following paragraphs we describe a free-running multivibrator, which, as well as being an interesting project to build, may also be put to a number of uses.

As a multivibrator produces an essentially square wave output, and it can be shown that a square wave comprises a fundamental sine wave plus odd order harmonics to infinity, the output of such a circuit is abundant in these harmonics.

In practice it is impossible to achieve a perfect square wave output so the number of harmonics produced is finite. Nonetheless, output wave shapes very nearly square are possible, and the harmonics from an audio frequency fundamental will extend well into the RF region.

Thus, the harmonic output of a multivibrator may be used for testing or fault-finding, in either radio or audio equipment. In this role it is used as a simple signal generator and with its output connected to the input of the equipment being examined, will produce an audible tone in the loudspeaker, or headphones, if all is in order.

To trace faults in radio receivers and audio amplifiers, the best method is to start at the loudspeaker end of the equipment and inject a signal into the final stage. If a signal is heard in the loudspeaker, work toward the input, stage by stage, until no signal is heard. This shows at which point the equipment is faulty and a more localised and thorough examination around the stage should reveal the fault.

Square waves are also very useful for testing performance characteristics of audio amplifiers. If we start with a "perfect" square wave, pass it through an amplifier, then display it on a CRO, the resultant pattern will tell us quite a lot about the amplifier's behaviour.

Naturally, a perfect amplifier will reproduce our square wave exactly as it was generated, but this is unlikely in practice. However, good quality amplifiers will come very close to this ideal. In general, there are three main amplifier characteristics which our square wave will check; high frequency response, low frequency response, and stability.

The frequency response may be only a rough check, since there are better, though more time consuming, ways of doing this. The stability check, however, can be most important. Where an amplifier has poor high frequency response, the "corners" of the square wave tend to be rounded, and an experienced observer can get quite a good idea of the degree of loss from the amount of rounding.

Poor low frequency response will be shown as an inability to preserve a level "top" to the wave, this being presented as an inclined plane. Once again experienced observers can quickly deduce the approximate order of loss.

Even assuming that these faults do not occur, it is most likely that there will be some "ringing" present. This takes the form of a small damped oscillation at one or both "corners" of the square wave, and indicates a degree of instability, or tendency to oscillation which, while not enough to make the amplifier oscillate continuously, is nevertheless sufficient to seriously degrade its ability to handle sudden wave fronts, or "transients," which form a significant part of musical sounds.

Unfortunately, we need a considerably more refined square wave generator than this simple device, in order to conduct these tests properly. For one thing, the square wave must be really square, or as nearly as we can make it, and must also be variable over a wide frequency range in order that we can select the best fundamental frequency for each test. Nevertheless, a test with this simple instrument would be a most instructive experiment.

This multivibrator is of the free running type, and a look at the circuit diagram will show that the collector of T1 is capacitively coupled to the base of T2 and the collector of T2 capacitively back-coupled to the base of T1. This cross-coupling results in a circuit that will oscillate due to positive feedback, oscillation being sustained because the loop gain is greater than unity.

The actual operation of this circuit is that one transistor is cut off while the other one conducts fully, this condition alternating between them at a rate determined by the value of associated components.

In order to understand how the multivibrator works, it is necessary to appreciate that the method of connection produces a condition whereby any change in collector current in one transistor, will result in an opposite change in the other transistor. Thus, if one collector current is increasing the other one will be forced to decrease, and vice-versa.

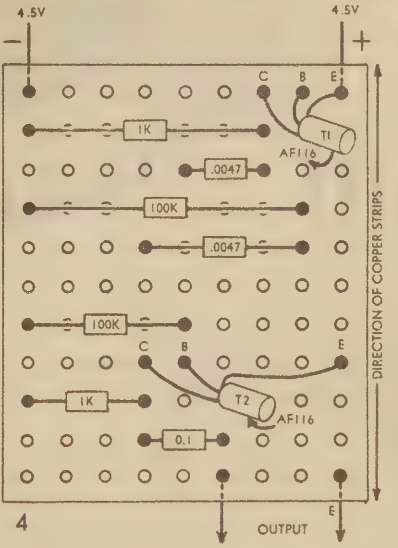
When voltage is initially applied to this circuit, and due to very small differences in component values, one transistor tends toward full conduction and forces the other toward cut-off. Because this is a regenerative loop circuit, this action takes place extremely quickly culminating in one transistor being cut off and the other conducting fully.

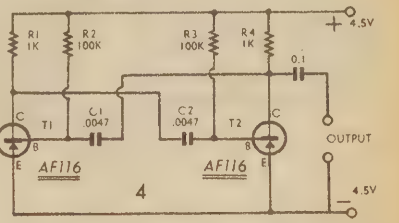
However, this condition cannot be maintained, because the coupling capacitors can transfer only the CHANGES which occur at each collector, and not the steady state represented by either cut-off or full conduction. Once this point is appreciated, we can follow the sequence of events through a complete cycle.

Assume that T1 is cut-off and that T2 is conducting fully. This condition makes the collector side of C1 less negative than the base side, which causes C1 to charge and drive the base of T1 negative, thus bringing it into conduction from its cut-off condition. This is regenerative, causing T1 to conduct

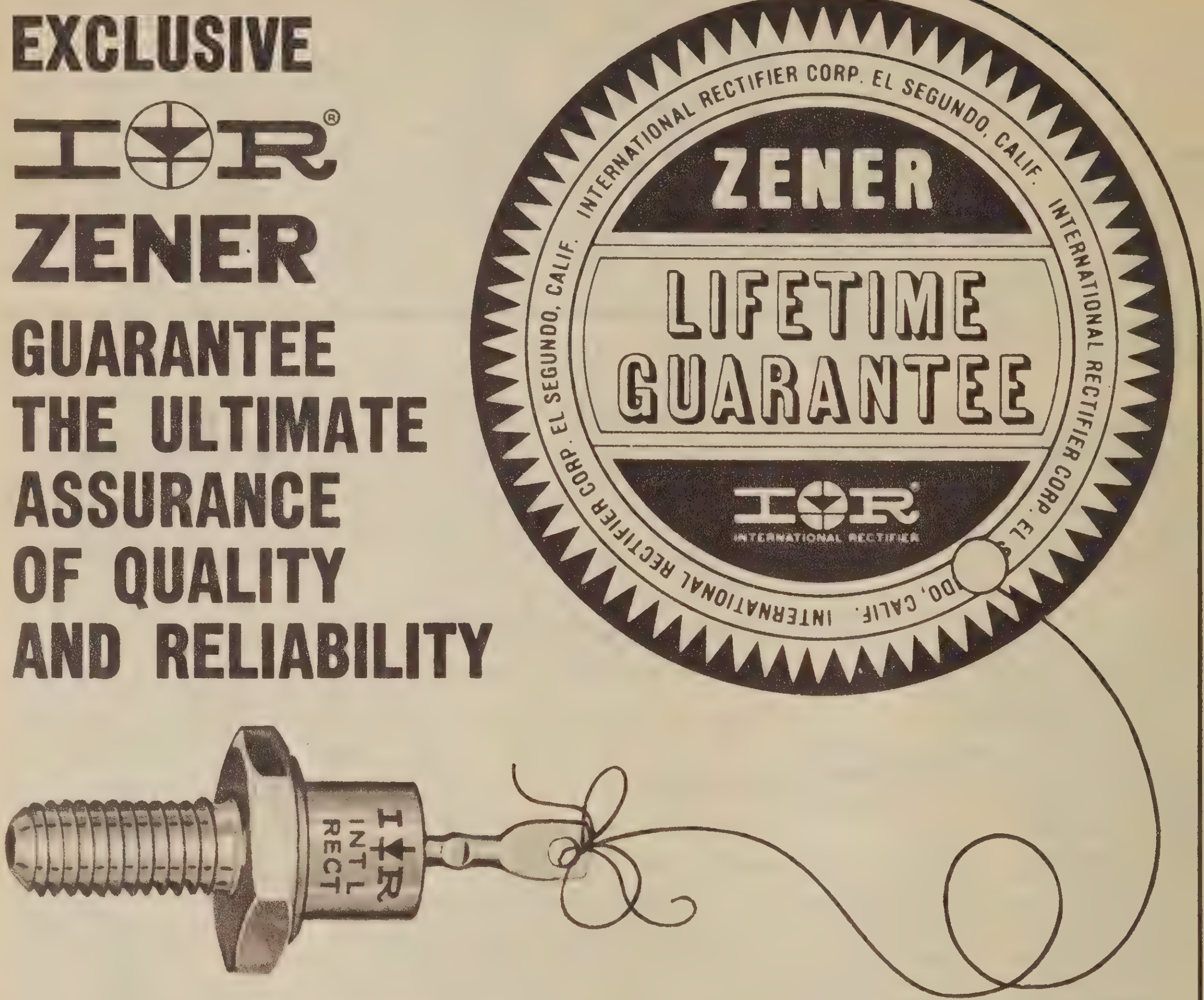
AUDIO—RF MULTIVIBRATOR

2 AF116 transistors.
2 1K ¼ watt resistors.
2 100K ¼ watt resistors.
1 0.1uF capacitor.
2 .0047uF capacitors.
1 piece sample Veroboard 1¾in x 1-3/8 in, 3, 1.5V pencil light batteries, signal and battery wires, sleeving.





EXCLUSIVE
IR® ZENER
GUARANTEE THE ULTIMATE ASSURANCE OF QUALITY AND RELIABILITY


INTERNATIONAL RECTIFIER CORP. EL SEGUNDO, CALIF. INTERNATIONAL RECTIFIER CORP. EL SEGUNDO, CALIF. INTERNATIONAL RECTIFIER CORP. EL SEGUNDO, CALIF.
ZENER
LIFETIME GUARANTEE
IR®
INTERNATIONAL RECTIFIER
IR
INTL
RECT

Warburton Franki, sole Australian representatives for the vast IR range are pleased to announce this exclusive Zener news. International Rectifier's nine years of Zener diode superiority is based on fact: 99.98803% demonstrated industrial reliability. This unmatched record makes IR's LIFETIME GUARANTEE possible. Only IR can offer it. The guarantee covers all IR Zeners: glass, top hat, flangeless and stud mounted from 250 mw to 50 watts, including JEDEC types, house numbered and temperature compensated devices. Look for the seal of IR's LIFETIME GUARANTEE. It is proof that the manufacturer has made no compromise with quality — it assures the user the ultimate in Zener diode performance.

FOR FULL INFORMATION ABOUT IR ZENERS AND THE LIFETIME GUARANTEE CONTACT:

WF WARBURTON FRANKI

ADELAIDE: 204 Flinders Street, 233-233.
BRISBANE: 13 Chester St, Fortitude Valley. 51-5121.
MELBOURNE: 220 Park St., Sth. Melb. 69-0151.
MOUNT GAMBIER: 92 Penola Rd., 23-841.
NEWCASTLE WEST: 844 Hunter Street, 61-4077.
SYDNEY: 307 Kent Street, 29-1111.
WOLLONGONG: 140 Keira Street. 2-5444.
HOBART, LAUNCESTON: Associated Agencies Pty. Ltd.

fully and T2 to be cut off. To complete a cycle, C2 now charges driving the base of T2 negative, and the cycle is repeated, but this time, in relation to the other transistor. The circuit continues subsequent cycles in this manner, and therefore oscillates by switching from one transistor to the other.

The pulse repetition frequency (prf), or speed of switching between the transistors, is determined by the time it takes C1 to discharge through R2 and for C2 to discharge through R3, and therefore the time constants of these components. Due to base leakage currents, and there being a discharge path through the bases of the transistors for C1 and C2, temperature also has some bearing on the prf.

Using the values shown in the circuit diagram our multivibrator oscillated at approximately 7KC. By feeding its output into the aerial of a communications receiver we found that the frequency range covered was from the broadcast band to 20MC, after which, the signal dropped off rapidly.

If the values of C1 and R2 equal those of C2 and R3, the mark/space ratio, or the on and off times of the square wave output, are equal and would be as shown in the circuit diagram. It is possible to alter this ratio by unbalancing C1, R2 and C2, R3, but if this unbalance is made too large the circuit will not function as a multivibrator.

The construction of a multivibrator on a sample piece of Veroboard is quite simple, as can be seen from the photograph, which also shows the general layout used. The accompanying drawing of the underside of the board shows the soldered connections necessary to form the circuit in conjunction with the components. The multivibrator functions quite well from a 4.5V battery.

5—Audio Frequency Oscillator

If this project seems to ring a bell for our regular readers, it should, for it is the Unijunction Morse Oscillator from last month's issue merely transferred to a sample piece of Veroboard.

There are several uses for an audio oscillator, apart from the Morse practice role dealt with in detail last month. One application is for fault finding in audio amplifiers. By applying its output to the input of the equipment being tested, then to the grid of the first stage, and so on through to the loudspeaker, a defective stage can be located.

This oscillator can also be used to modulate an RF signal generator but, due to its non-sinusoidal output waveform and, therefore, high harmonic content, it is most definitely NOT recommended for modulating transmitters.

The circuit is basically the same as that for last month's oscillator, but with the addition of a 250K switch potentiometer for frequency control and supply switching, and a 220 ohm resistor, in place of the speaker or phones, across which the output signal is developed.

Since originally presenting this circuit, another type of unijunction transistor, the 2N2646, has become available which operates equally as well as the 2N2160 in this application, and probably more important, is less expensive. For this reason we have specified the 2N2646 as a first choice, if available.

A comprehensive description of the construction and action of a unijunction transistor is not within the scope of this article, and we refer the reader to last month's article, where such a treatment can be found. However, and very simply, it is a "relaxation" circuit in which the .05uF capacitor charges through the 250K potentiometer and 3.3K series resistor, discharging through the unijunction and the 220 ohm resistor in B1. Due to an "inbuilt bias," which the unijunction provides for itself, the capacitor has to charge sufficiently to overcome this bias level to bring the unijunction into conduction in order to discharge.

Therefore, the frequency with which the events are repeated as an oscillation, depends mainly on the time taken for the capacitor to charge to the inbuilt bias voltage of the unijunction — in other words, on the time constant of the resistor and capacitor. The larger the resistor, or capacitor, the slower the charging and the lower the frequency of oscillation. Conversely, the frequency may be increased by reducing the value of resistor or capacitor. In this circuit, we maintain a constant value of capacitance and alter the value of resistance by means of the potentiometer to achieve a change in frequency. Using the values specified, our little oscillator has an approximate frequency range of 100 cycles to 6KC.

As too low a value of resistance will prevent oscillation by keeping the unijunction "on" all the time, a 3.3K resistor is included in series with the potentiometer as a safe minimum value for maintaining oscillation with the potentiometer wound out of circuit.

The type of potentiometer, and the "way round" it is connected, needs to be considered if we are to get a reasonably smooth and well-spaced frequency control.

First, let us consider what would happen if we used a linear pot in this position. Due to the manner in which the circuit functions, the highest frequency is produced with minimum resistance in circuit. Since the total resistance is low, a small increase in resistance represents a significant percentage change, resulting in a significant frequency change for a small movement of the control knob. Conversely, at the low frequency end, where a lot of resistance is involved, a large change is needed for the same percentage change and the knob movement is well spread out.

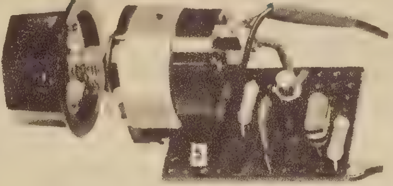
This would be the case if we used a linear pot, but if we use the more conventional and readily available "log" pot, we find that the situation is even worse if we wire it to produce the conventional increase in frequency with clockwise rotation of the knob. The ideal, then, would be an "anti-log" pot, or one having just the reverse characteristics of a log pot. Such devices are available, but not always "off the shelf" at the nearest store.

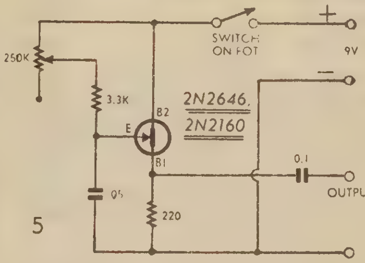
However, we can achieve much the same result by simply wiring a conventional log pot. in reverse; the only objection being the minor one that the frequency will be highest at the anti-clockwise or "switch-on" position, decreasing as the knob is rotated clockwise.

Construction of this unit is straightforward, the necessary details regarding component layout and underside soldering points being given in the drawings. Potentiometer mounting is achieved by soldering its bottom end tag to the copper strip holding the top end of the 3.3K resistor, with the slider connected to the positive supply by a flying lead. The positive supply lead from the battery is taken via the switch potentiometer, the negative lead being taken straight to the board.

At the time of construction, we were unable to acquire a miniature 250K log switch potentiometer and were forced to use the standard type, as seen in the photograph, being larger than desired for this type of project. However, readers may be able to obtain a smaller version of this component for their unit.

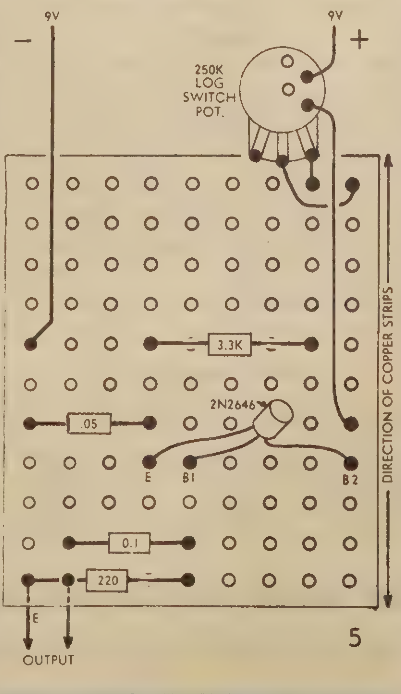
AUDIO OSC.





5

1 2N2646 unijunction transistor.
1 250K log switch potentiometer.
1 3.3K ½ watt resistor.
1 220 ohm ½ watt resistor.
1 0.1uF capacitor.
1 .05uF capacitor.
1 piece sample Veroboard 1¾in x 1⅜ in, 1 9V battery, signal and battery wires, sleeving.



AUSTRALIAN SOUND AND TV CO. PTY. LTD.

35-39 YARRA BANK ROAD, SOUTH MELBOURNE

61-3024 **TELEGRAPHIC ASSOUND. MELBOURNE** **61-3192**

Manufacturers and designers of the most reliable commercial amplifiers available today. Any of our stock amplifiers will meet any standard Government Specification. Each individual amplifier is custom built. Our 250/300 watt units were selected for the Qantas project in Sydney in competition with American counterparts. All amplifiers can be purchased tropicalised.

3/5W	**$42**
12/15W	**$62.62**
30/40	**$77.50**
60/70	**$98.30**
100/120	**$113.30**
250/300	On application

Complete with Hi Imp input and tone control Pick-up input and tone control, 100 V line out. Tax 12½% unless to be used for Music purposes then 25% 50 ohm input with Mu Metal transformer mounted on chassis—$15.25 additional.

Transistor amplifiers.
A.S.T.—5/12 W, **$28** to **$42** plus 12½% sales tax.
A.S.T. 30/40 W Guitar amplifiers, **$180** plus 25% sales tax.
A.S.T. Transistor amp 5W—V/C out **$28.**
A.S.T. Transistor amp 10W—V/C out **$40.**

Tax 12½%.

A.S.T. Radio tuners from **$10.**

MEDDING tuners improved **$25.50.**
MEDDING 8/8 stereo improved, **$52.**
Language laboratory recognised as the most comprehensive in the world designed to State School requirements by the Royal Melbourne Technical College and built by A.S.T.V. (Printed circuit). Prices according to requirements.

OVER 200 GENERAL LINES PRICES: SOME POPULAR LINES

Microphone stand floor type, 3ft to 6ft ext. **$8.**
Microphone stand, Banquet 3ft to 6ft ext. **$5.25.**
Microphone stand, Desk with P.M.G. switch. any type insert can be fitted internally, **$7.50.**

Mu Metal mike transformer, 50 ohm, 200 ohm and 600 ohm, **$3.70.**

Complete range CANNON Microphone connectors.

3 Oval Most Popular Rola first quality speakers 5 x 4, **$22.67.**

= to 4 Round variable tappings, 2.5 to 10W.
4 As above, **$26.**
=to 6 Round variable T 5 to 15 W

4 Weatherproof outdoor col (Metal) **$40.50.**

Rola 7 x 5 speakers.
=to round 7.

Complete with mounting brackets 5 to 15W.

Voice coil output approx. **$2.60** less.

Radio paging system V.H.F. "Toshiba" or Loop System.

Junior P.A. alloy flare, 8in, ... **$8.**

Senior P.A. alloy flare, 8in, . . **$10.50.**
Gal fittings

Speaker Boxes Double and Single

Single, 5in	**$2**
Single, 6in	**$2.03**
Single, 8in	**2.10**

A special demonstration portable P.A. sound column fully transistorised operates off torch batteries complete with hand mike and switch and fitting for stand.

LECTURN lecturing system incorporating the above unit and portable sound column.

Classic (Reid Murray) 5 valve radiogram chassis complete with 12in Rola Speaker and dial glass (job line) our guarantee applies. **$52** Tax Paid. All types of "Aiphone" talk back system. Inter office phones.

Master and 1 slave
Master and 2 slave
Master and 5 slave up to 10 Master

POLICY:

All goods plus the appropriate sales tax.
Spare parts available for all imported goods—**our guarantee,** if we haven't the spare part we will replace the whole unit, **2 year warranty.** All wattage ratings are R.M.S. To compare with Jap and American ratings which are peak, double our ratings. All valves and transistors 90 days' guarantee. 12 months against fair wear and tear returned to the factory for service.
Mr Wholesaler, you are covered.

SATO PRODUCTS

9—various knobs all colours, brass inserts from **$0.06** to **$12.05.**

General purpose pointer knob	**$0.08**
Jack plus	**$0.30**
Jack plug, All metal	**$0.50**
Jack plug, P.M.G. type	**$0.75**
Jack plug Socket, Single Circuit	**$0.30**
Johnston 2-pin phased plug and socket	**$0.63**
3-Panel fuse holder, standard metal nut—Front Loading	**$0.35**
Min—Co-axial Plug and Socket with cover Socket	**$0.08**
Plug with cover	**$0.04**
Bezels (Pilot Lights) Min. 5 colours with globes, 8V	**$0.26**
Spare Globes	**$0.06**
Bezels (Pilot Lights, 5 Colours, ½in take Standard Lamp	**$0.18**

TOA PRODUCTS
Australian Agents

The most efficient manufacturer in Jap. manufactures 80% of P.A. equipment and sold to you at Jap. prices.

Reflex Exponential Flares

24in wide angle	**$27.63**
20in Medium angle	**$14.84**
11in Small angle, 10W+	**$27.90**
8in Small angle, 10W+	**$18.13**
8in Small angle, 10W 16 ohms out.	**$12.25**
5in Small angle 5W 16 ohm out.	**$6.53**

Rectangle reflex flares

8in x 15in x 10W	**$20.91**
7in x 11in x 10W	**$19.41**
5in x 8in x 10W	**$13.44**
4 in x 6in x 5W	**$12.33**

Driver units with weatherproof matching transformers as an integral part, 5 taps includes 100V line and voice coil.

15W	**$13.58**
20W	**$15.55**
25W	**$14.55**
35W	**$24.39**
15W 16 ohm voice coil	**$9.14**
35W 16 ohm voice coil	**$14.00**

Matching transformer waterproof with mounting brackets for all voice coil outputs **$5.75**

+Includes weatherproof, etc., as above (Driver Units).

Transistor, 13/20W **$45.39**

BACKGROUND MUSIC SYSTEMS

Cassette type, 2 hours.
Standard Deck, 4 hours.

Including music tapes rental as above **$3.50** per week or can be purchased outright.

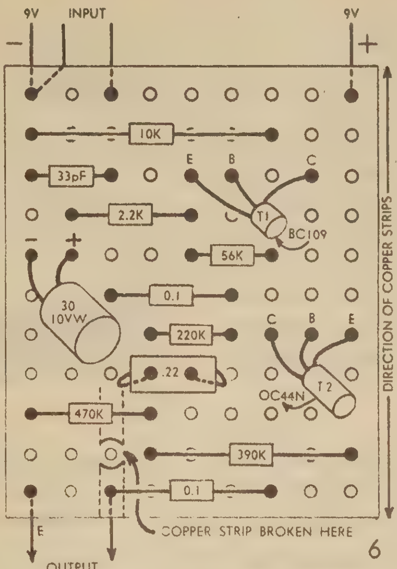
All the goods on the shelf as far practical.

ALL GOODS ON SHELF AS FAR AS PRACTICABLE

PRICES PLUS PACKING F.O.R. MELBOURNE

The oscillator operates well from a 9V supply and is capable of driving either a 15 or 33 ohm loudspeaker, or a set of high impedance headphones, at a clearly audible level.

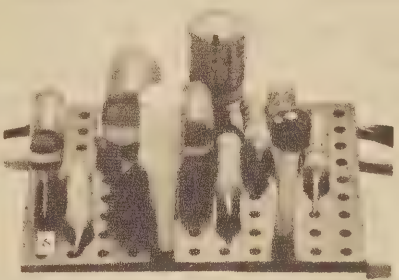
6—Crystal Mic. Preamplifier

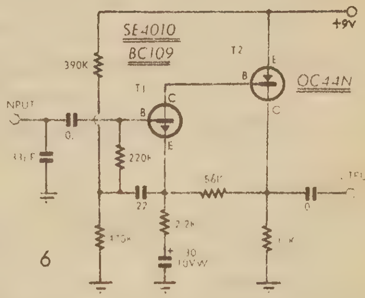


6

- 1 SE4010 transistor
- 1 OC44N transistor
- 1 2.2K ½ watt resistor
- 1 10K ½ watt resistor
- 1 56K ½ watt resistor
- 1 220K ½ watt resistor
- 1 390K ½ watt resistor
- 1 470K ½ watt resistor
- 1 33pF capacitor
- 2 0.1 capacitors
- 1 .22 capacitor
- 1 30uF 10 volts working electrolytic capacitor
- 1 piece sample Veroboard 1¾in x 1⅜in, 1, 9V battery, signal and battery wires, sleeving

CRYSTAL MIC. PREAMPLIFIER





6

Sooner or later, most radio enthusiasts have need of a microphone circuit, a facility not always available even in many elaborate amplifiers. The reasons for this need are many and varied.

Since cost often has to be considered, it is natural to ask whether an existing receiver or amplifier can be used for this purpose, either by adding something to it, or by selecting a suitable microphone. Depending on the individual's pocket, the microphone used could either be a crystal, dynamic, or even ribbon type, but since the crystal type is capable of quite good performance at a very reasonable cost, it is a very popular and logical choice.

However, regardless of the type finally selected, the output will be very much lower than, say, that of the conventional crystal pickup, and will require considerable amplification before it is strong enough to be fed into the pickup terminals of a standard audio amplifier.

Furthermore, if we do select a crystal type, it is essential that the input circuit to which it may be connected provides a high impedance; ideally about 5M but certainly not less than 1M. Otherwise, the bass response of the microphone will be seriously attenuated. Our simple pre-amplifier is designed to satisfy both these requirements.

The circuit may appear a little unconventional at first, and it may be helpful to discuss briefly some of its more important features. It is a two stage directly coupled amplifier, using an NPN (SE4010 or BC109) first transistor and a PNP (OC44N) second transistor.

Apart from the direct coupling, the main feature is the input circuit to T1, designed to provide the high input impedance necessary for the crystal microphone.

The 220K resistor and the .22uF capacitor, connected as shown between the emitter and base, is known as a "bootstrap" arrangement, which has the effect of increasing the input impedance to a much higher value than that of the 220K resistor, by decreasing the normal shunting effect of this resistor.

This circuit functions, broadly, something along the same lines as the emitter follower, in which negative feedback is used to increase the apparent input impedance, by using the amplification of the stage to develop what might be termed a "bucking" voltage across the input load, so that very little current can flow through it from the signal source. Thus the source "sees" what appears to be a very high resistance.

To understand how this is achieved, we have to consider an input signal applied to the circuit. This signal appears at the emitter of T1 at nearly its full magnitude, due to the amplification of the transistor, and is applied via the .22uF capacitor to the lower end of the 220K resistor. This now means that there is very little difference in the signal present at either end of the resistor, and it accordingly passes very little current. Thus, as far as the input circuit is concerned, its impedance has been effectively raised. In fact, the effective input impedance is raised to greater than 2.2M. This is one method of conveniently increasing the input impedance of a transistor stage, using only one extra resistor and capacitor.

The 56K and 2.2K resistors provide both negative feedback and thermal stabilisation for the transistors, the latter being dealt with more fully in our Two Stage Audio Amplifier project. The 30uF capacitor supplies the AC path to chassis. The 10K to chassis is the collector resistor for T2, and the output developed across it is extracted via the 0.1uF capacitor.

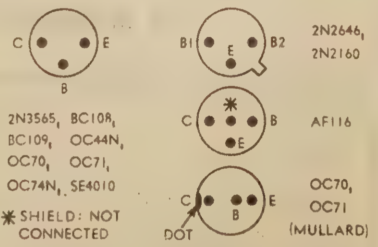
This little unit performs very satisfactorily from a 9V supply.

Although there are a larger number of components to be accommodated on our sample piece of Veroboard, the project is simple to construct and presents no problems. The component layout is illustrated and it should be noted that it is necessary to cut the input/ouput copper strip at the point indicated in order to maintain the correct circuit and mount all the components on the one board. A special tool is available for cutting the copper strip, but in its absence, a razor blade or ⅛in drill will do the job nicely.

When it has been built and the equipment set up for test, don't be surprised if the whole thing screams its head off as soon as the volume control is advanced. This will be due to acoustic feed back caused by the microphone picking up signals from the speaker and feeding them back into the system. This is quite normal, and it is best to place the microphone as far away from he speaker as possible. Indeed, to turn the system up for testing it would be best to locate them in separate rooms.

The tendency to feed back will be aggravated by any peak in the system, since the system will spill over at this frequency before a useful level is reached at other frequencies. Many of the cheaper crystal microphones have a tendency to peak badly, and these types should be avoided if possible.

Where such peaks exist, due to the microphone or any other cause, it is sometimes possible to minimise their effect by limiting the top response of the system with a conventional "tone control." Naturally, there is a limit to the amount of top cut that can be tolerated, but it is often possible to select a degree which is a suitable compromise between feed back and top response. ■



This diagram illustrates the collector, base and emitter connections for the transistors used in these projects.

Eddystone UHF COMMUNICATIONS RECEIVER **990S**

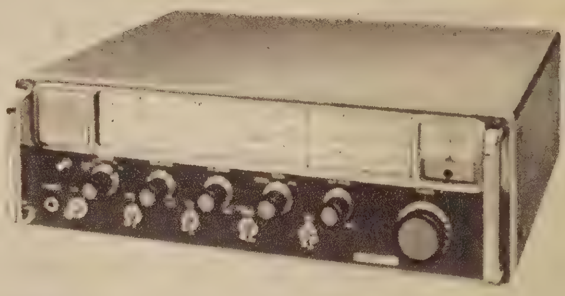
A fully transistorised single conversion superheterodyne for reception of AM and FM signals in the ultra-high frequency band from 230 M/cs to 870 Mc/s, Operation is from any standard AC mains supplies or from a 12 volt DC supply. Available in patterns for table mounting of for fitting into a standard rack. Operational temperature range 0 to 50 degrees Centigrade.

Frequency Coverage

Two ranges are displayed on horizontal scale over 9" wide, the coverage being 470 to 870 Mc/s on Range 1, and 230 to 510 Mc/s on Range 2.

Price: $1165.18 duty paid. Plus sales tax. Duty free price on application.

THERE IS AN EDDYSTONE RECEIVER FOR ANY REQUIREMENT FROM 10 Kc.s to 1000 Mc.s



Noise Factor

Range 1 .. .. 10 to 16 dB.
Range 2 .. .. 8 to 12 dB.

Panoramic Reception

The addition of an EP17R Panoramic Display Unit and Cat. No. 939 IF. Convertor Unit permits visual display over the whole range of frequencies covered by the receiver. This combination bears the reference EPR29.

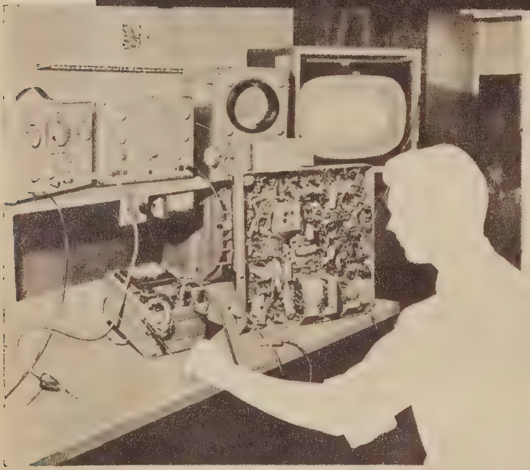
Australian agents:

R.H.Cunningham PTY. LTD.

SYDNEY—
64 ALFRED STREET,
MILSONS POINT
929-8066

MELBOURNE—
8 BROMHAM PLACE
RICHMOND
42-1614

Put yourself in the picture



Electronics, to-day, is a rapidly expanding science—demanding a full knowledge of theory and practice. Only a complete mastery of electronic applications and of modern test instruments can qualify you to join its march of progress. The Marconi School, with full and ready access to the vast experience, advanced equipment and world-wide ramifications of A.W.A., can train you to qualify . . . .

- **EFFICIENTLY,**
- **THOROUGHLY,**
- **SPEEDILY**

COURSES AVAILABLE:

Radio Communication : Radio Operating at Sea, on Land ; Broadcast Station Maintenance ; Radio and TV Servicing.

Please send me without obligation your prospectus

NAME...

ADDRESS...

....

MARCONI SCHOOL OF WIRELESS
Conducted by
AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

FILL IN AND POST COUPON TODAY TO
MARCONI
SCHOOL OF
WIRELESS
G.P.O. BOX 2516 SYDNEY
G.P.O. BOX [illegible] MELBOURNE

MS3 59

SYDNEY: 47 YORK STREET, SYDNEY 2 0233
CLASSROOMS AND OFFICES: 21 Pier St. (below Goulburn St.) Sydney.

the "Answer Man" Explains

Torr units and ionisation gauges

The first question posed to the Answer Man, this month, is about nothing in particular — and we mean precisely that. He wants to know about a vacuum!

I recently saw a reference to "Torr units" and to ionisation gauges, which are apparently used for measuring vacuum. Will you please explain what a Torr is and how the ionisation gauge is used for vacuum measurement?

Before explaining about Torr units and ionisation gauges, we will first establish what we mean when we talk about vacuum.

Theoretically, a vacuum (from the Latin word vacuus, meaning empty) is a space containing nothing at all. However, there is no such thing as a perfect vacuum recognisable by our technologies, and what we loosely term "vacuum" is, in fact, space occupied with gas considerably below ambient (atmospheric) pressure.

The Torr is the unit of measuring gas pressures in vacuums. It is named after the Italian physicist, Evangelista Torrecelli, who invented the mercury barometer, the first practical device for measuring atmospheric pressure above and below ambient. His barometer measures pressure by the height of a column of mercury in a capillary tube.

At sea level, which is the nearest we can get to a mean reference level in all parts of the world, atmospheric pressure is defined as the pressure required to maintain a column of mercury at a height of 760 millimetres, when the temperature is 0 deg. C. (Physicists take other conditions into account, but we need not be concerned with these.)

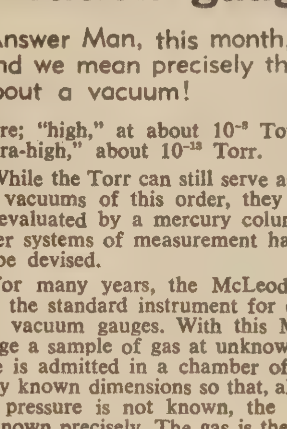
For his own purposes, the physicist prefers to regards the column of mercury as exerting pressure on the atmosphere, rather than the other way around, so he defines atmospheric pressure as the pressure exerted by a column of mercury 760 millimetres high, at 0 deg. C.

One Torr unit is the pressure exerted by a column of mercury one millimetre high at 0 deg. C., so this is well into the vacuum region. To define the conditions even more closely, the Torr is to be taken as applying at sea level, at 45 degrees latitude. Naturally there are compensating factors to be taken into account under other conditions.

The Torr is, therefore, a convenient unit for calibrating instruments used for measuring pressures below atmospheric. Vacuums are roughly classified as "medium," at pressures in the region of 10^{-3} Torr, or one-thousandth of a millimetre; "high," at about 10^{-8} Torr; and "ultra-high," about 10^{-13} Torr.

While the Torr can still serve as a unit for vacuums of this order, they cannot be evaluated by a mercury column and other systems of measurement have had to be devised.

For many years, the McLeod gauge was the standard instrument for calibrating vacuum gauges. With this McLeod gauge a sample of gas at unknown pressure is admitted in a chamber of accurately known dimensions so that, although the pressure is not known, the volume is known precisely. The gas is then compressed by a mercury piston, in a capillary tube calibrated in volume units, to a predetermined pressure, and the new volume of gas at this pressure is read off from the calibrated capillary tube. The original pressure of the gas can then be calculated from the ratio of the volumes.



This diagram illustrates the principle of the simple mercury barometer invented by Torricelli. The sealed arm of the tube is filled with mercury while the tube is held in an inverted position. When the tube is turned right way up the mercury will drop in the tube, thus creating a partial vacuum in the sealed tube. The pressure of the atmosphere will support the column of mercury at a level corresponding to the ambient pressure. At sea level, the atmospheric pressure corresponds to a level of 760 millimetres of mercury in the column.

However, McLeod gauges are suitable only for measurements down to 10^{-5} Torr, and vacuum physicists can now produce vacuums at pressures far below this.

The ionisation gauge was developed to allow measurement of the very low pressures of the ultra-high vacuum regions around 10^{-13} Torr. The basic principle applied in this system of measurement is that gas pressure and gas density are closely related, so that if one is known the other can be calculated.

Gas in the vacuum system is bombarded with electrons, resulting in the formation of positive ions. These ions are collected by the ionisation gauge and the degree of gas density in the vacuum under measurement can be determined by the concentration of ions formed.

The ionisation gauge is basically a vacuum valve, with anode, cathode and grid. The cathode is a tungsten filament surrounded by a grid wound in the form of a spiral. The anode is a metal cylinder enclosing both cathode and grid. These electrodes are enclosed within a glass envelope but, unlike the ordinary valve, the envelope is not evacuated and is provided with a tube for connection to the vacuum system to be measured.

Electrons from the heated filament are accelerated by the grid toward the anode. When any of these electrons collide with gas particles present in the vacuum, positive ions are formed, and the number of ions so formed is directly proportional to the gas density and indirectly proportional to the gas pressure. Because the anode is maintained at a negative potential it collects the positive ions. This causes an "ion current" to flow, which can be measured and related to ion formation, gas density and gas pressure.

* * *

There was a lot of publicity, a couple of years back, about 16mm movie projectors with magnetic sound. Has the idea died?

There is nothing wrong with the basic idea; it is a matter of usage. Most 16mm projectors are used to show release prints of documentary, religious and feature films and the industry is based on the use of the optical sound system. In general, the quality of reproduction is good enough as not to demand a change. Magnetic tracks would also present problems in that each would require to be dubbed.

The position is quite different for 8mm films, where optical sound is rather impractical and where magnetic tracks offer the chance of getting sound on to individual films.

The Most Popular Mono/Stereo High Fidelity Tape Recorder Ever Available in Australia!

TANDBERG 74B

4 TRACK COMPLETE MUSIC SYSTEM

The Tandberg Model 74B is a complete stereo recorder for high fidelity recording and playback, featuring built-in stereo amplifiers and two wide range loudspeakers. Completely portable and self-contained, this precision recorder incorporates three speeds, heads are four-track configuration and the unit has provision for connection of external high fidelity loudspeaker systems (or your home amplifying system).

Music can be recorded on one track, speech or lyrics added on another, and both tracks may be played back through the central channel — making the 74B the most versatile quality recorder on the market. This feature also makes the 74B ideal for language study applications. The lesson is recorded on Channel 1 and the student responds on Channel 2; both tracks are played back through the central channel. Comparison of pronunciation and intonation are greatly simplified.

Individual level indicators show the recording level on each channel. Sound-on-sound facilities and monitoring while recording are invaluable features of the Tandberg Model 74B.

Without reservation it may be claimed that the Tandberg 74B stereo tape recorder is the most versatile, most advanced and extensively proven stereo tape recorder on the market.

SPECIFICATIONS:

Three speeds — 7½, 3¾ and 1⅞ i.p.s.
Speed tolerance — Plus or Minus 1.5%.
Valves — 1 x ECC 82, 4 x ECC 83, 2 x EL 84 2 x EAM 86, 1 rectifier and two transistor AC 107.
Frequency response — 7½ i.p.s. 20 c/s-20 kc/ (plus or minus 2 dB 40-16,000 c/s), 3¾ i.p.s 30 c/s-13 kc/s (plus or minus 2 dB 40-10,000 c/s)
Wow and Flutter % R.M.S. — 7½ i.p.s. bette than 0.15%. 3¾ i.p.s. better than 0.2%. 1 i.p.s. better than 0.3%.
Signal to Noise Ratio —
4 track 53 dB.
2 track 56 dB.
Input sensitivity — Each microphone channel 2. mV. Radio input-Adjustable from 2.5 mV to 7 V
Outputs — 2 x 3 watts. Centre channel and radi output 0.5 to 1 V at 100 k.
Weight — 27½ lbs.
Size — 15⅜" x 11⅞" x 6⅞".

Australian National Distributors :

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth Street, Melbourne, Vic. Tel. 63 8211, 63 8166
Sydney Office: 26 Ridge Street, North Sydney, N.S.W. Tel. 92 3890.

INTERSTATE REPRESENTATIVES:
N.S.W.: Audio Engineers Pty. Ltd., 342-344 Kent Street, Sydney. Tel. 29 6731
S.A.: Eilco Sales Pty. Ltd., 9 Osmond Terrace, Norwood. S.A. Tel. 3 6345
Q'land: Sydney G. Hughes, 154-158 Arthur St., New Farm, Brisbane. Tel. 58 1014
W.A.: Athol M. Hill, 613-615 Wellington Street, Perth. Tel. 21 7861
Tas.: K. W. McCulloch Pty. Ltd., 109 York Street, Launceston. Tel. 2 5322
A.C.T.: Australian Physical Laboratories, P.O. Box 225, Canberra City.
Tel. 4 3010 (Mr. J. E. Howe)
N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801

THE MOST REALISTIC HIGH FIDELITY SOUND ORIGINATES WITH

Ortofon

Illustrated is the SMG 212 tone arm and the SPU-GT-E cartridge. ORTOFON tone arms are available in 9 models. Type "A" cartridges are for general hi-fi use . . type "C" for professional users and the serious music lover. The SPU series has been designed for all high quality stereophonic applications. Any cartridge may be used with ORTOFON "G" arms when fitted with the open-front metal "G" shell

The ORTOFON elliptical diamond stylus closely approximates the shape of the original cutting stylus, and will track the most complex wave form without distortion due to pinch effect. Freedom from distortion is obvious towards the centre of a disc where pinch effect is always a problem. Tracking pressure of 2 grams and less minimises stylus and record wear.

Over 90% of Australian professional users . . . the radio and television stations and recording studios . . . have standardised on ORTOFON moving coil pickups. What are the advantages of the ORTOFON moving coil system? Firstly, the ORTOFON system is inherently more linear, as well as being consistently stable and predictable . . . and **absolutely free from distortion.** Stereo demands higher performance standards and even minute distortion is unacceptable; non-linear distortion makes the best high fidelity system sound second rate. Other magnetic systems such as variable reluctance, moving iron and moving magnet are subject to problems involving non-linear hysteresis and transient distortion. ORTOFON moving coil principles completely eliminate these factors. An open invitation is extended to you to compare the ORTOFON SPU-GT-E moving coil cartridge (illustrated) with any other cartridge regardless of price . . . and listen to the astounding difference!

FOR GREATER CLARITY AND NATURAL MUSICAL REPRODUCTION OVER THE COMPLETE SOUND SPECTRUM INSIST ON

Wharfedale LOUDSPEAKERS

Audio engineers and music lovers enthuse over Wharfedale clarity . . . right through the frequency range! Constant research by Wharfedale guarantees the Wharfedale you buy is the most effective speaker in its class. Exclusive roll surrounds permit maximum cone excursion in sealed or small enclosures to give outstanding bass response—high frequency response is substantially linear due to the use of Wharfedale's unique double diaphragm.

The Wharfedale range includes:—
★ 8" Bronze ★ 8" Bronze RS/DD ★ Super 8 RS/DD ★ 10" Bronze RS/DD ★ Golden 10 RS/DD ★ Super 10 RS/DD ★ RS 12 DD ★ Super 12 RS/DD ★ W12/RS/PST ★ W12/EG ★ W15/EG (Illustrated—Super 12 RS/DD).

Send today for your FREE descriptive catalogue and detailed specifications

Australian National Distributors :

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth Street, Melbourne, Vic. Tel. 63 8211, 63 8166
Sydney Office: 26 Ridge Street, North Sydney, N.S.W. Tel. 92 3890.

INTERSTATE REPRESENTATIVES:
N.S.W.: Audio Engineers Pty. Ltd., 342-344 Kent Street, Sydney. Tel. 29 6731
S.A.: Eilco Sales Pty. Ltd., 9 Osmond Terrace, Norwood. S.A. Tel. 8 6345
Q'land: Sydney G. Hughes, 154-158 Arthur St., New Farm, Brisbane. Tel. 58 1014
W.A.: Athol M. Hill, 613-615 Wellington Street, Perth. Tel. 21 7861
Tas.: K. W. McCulloch Pty. Ltd., 109 York Street, Launceston. Tel. 2 5322
A.C.T.: Australian Physical Laboratories, P.O. Box 225, Canberra City.
Tel. 4 3010 (Mr. J. E. Howe)
N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801

Accuracy of capacitance measurements*

How closely may capacitance be measured with a given type of instrument? Will a capacitance meter suffice for a particular measurement; and if not, will a low-priced, medium-priced, or high-priced bridge be required? Or is some other instrument suitable? These are questions which arise naturally in the mind of a serious worker with capacitors.

A number of capacitance-measuring instruments and set-ups are in regular use. In fact, their number is large enough to confuse the non-specialist. Some have been chosen on the basis of best suitability, while others owe their adoption to availability, low cost, familiarity, or plain accident. The new user must select the correct instrument for his purposes and he has few guideposts. It is not a matter of rationality of instrumentation (ordinarily, one never expects to find a radio and television service shop equipped with a $2,000 capacitance bridge, nor an engineering research laboratory with a kit-type capacitance meter)—but one of suitability. What instrument should I have?

Where capacitance measurement is the sole requirement and where a number of instruments provide the same capacitance ranges and test voltages, accuracy sufficient for the purpose seems to be the best criterion for selecting the instrument.

It is not unusual that capacitance measurement accuracy should differ between the various measurement systems, since they employ different numbers of components, each of which is subject to shift in value, and different controls and adjustments. Furthermore, they employ different circuits and methods of readout. This article compares the accuracy of common capacitance measuring instruments, based upon a study of performance data, instrument manufacturer's specifications and current literature.

CAPACITANCE METERS: These are the simplest instruments for measuring capacitance, since, like non-electronic voltmeters or current meters, they require no manipulation. They are most useful in test operations, such as trouble-shooting, where a direct indication of capacitance is desired at the greatest possible speed.

There are four principal varieties: **Reactance meter, ratio meter, beat-frequency meter** and **multi-vibrator meter.**

The simple, service-type **reactance meter** is essentially an AC milliammeter connected in series with a known AC voltage and the unknown capacitor. Ideally, current flowing through the circuit is proportional to voltage and reactance and, assuming constant voltage and frequency, the meter scale accordingly may be graduated directly in microfarads. Several capacitance ranges may be provided. Simple reactance meters, such as those employed in electronic servicing and often incorporated in multimeters, must be operated from the specified mains voltage and frequency.

This is the least accurate type of capacitance meter, ±5% to ±15% of indicated value being common. A part of its inaccuracy is due to the fact that this instrument circuit responds not simply to the reactance of the test capacitor, but to its impedance. If the resistive component of this impedance is significant in magnitude, the meter scale (which has been calibrated on the basis of pure capacitance and reactance only) may be appreciably in error. It is possible for the percent error to be equal numerically to the power factor of a capacitor under test. Other important causes of error are difficulty in holding the test voltage and sometimes the test frequency constant and inaccuracies in the rectifier-type indicating meter.

A laboratory-type capacitance meter of the reactance type has appeared relatively recently, in which the shortcomings of the simple service-type instrument have been eliminated. Improved accuracy ±2 % to ±5% of indicated capacitance) has been obtained by use of a frequency-stabilised and voltage-stabilised internal 1000cps test signal source, very-low resistances across which the capacitor current develops the indicator voltage, and an accurate vacuum-tube millivoltmeter (rather than a rectifier-type milliammeter) as the indicator.

The **ratio meter** is an electrodynamometer-type instrument which reads directly in microfarads. Its operation is almost free from the effects of test voltage, test frequency, and capacitor power factor. However, the phase angle of the capacitor must not exceed 3 degrees. Accuracy is 1% of full scale below 0.3 and 0.333% of full scale at 0.3 and higher. This type of instrument is supplied for use at specified frequencies of 50, 60, or 500cps and specified AC line voltages of 100-130V and 200-250V.

Like the laboratory-type reactance meter, the **beat-frequency** meter is a refined instrument. It contains two highly stable oscillators, one fixed in frequency and one variable, which are set initially to zero beat with each other. The unknown capacitor then is connected in parallel with the tank of the variable oscillator, which it accordingly detunes. This causes a beat note to be generated at a frequency equal to the difference between the two oscillator frequencies, and this beat-note signal actuates a direct-reading electronic audio frequency meter. The scale of the latter is graduated directly in picofarads instead of cycles per second. This direct-reading instrument has an accuracy of 3% full scale.

In the **multivibrator-type meter,** a constant-amplitude, constant-frequency, square wave voltage, generated by a free-running multivibrator, is applied to a rectifier-type AC meter in series with the unknown capacitor. Under conditions of constant amplitude and frequency, the deflection of the meter is proportional to the capacitance, and the meter consequently may be graduated directly in picofarads. Capacitance ranges are changed by switching the frequency of the multivibrator in discrete steps. Accuracy of this instrument is of the order of ±5% of indicated capacitance.

RESONANT CIRCUIT: An unknown capacitance (C) may be connected in parallel with an accurately known inductance (L) to form a test tank circuit, and the resonant frequency (f) of this combination determined by means of a signal generator loosely coupled to the tank. At resonance, the voltage across the capacitor is maximum and may be indicated by a high-impedance AC vacuum tube voltmeter connected in parallel with C.

After the resonant frequency has been determined, the unknown capacitance may be calculated from the known tank constants: $C=1/(4\pi^2f^2L)$. This method of measurement makes no allowance for distributed capacitance of the inductor or for stray circuit capacitance, so that the calculated capacitance may be significantly inaccurate because of these parameters. Also, the frequency must be known closely.

The resonant-circuit method is often used with a temporary bench setup of signal generator, inductor, unknown capacitor, and vacuum tube voltmeter. If the wiring is rigid, connections short, and test area free of electrical interference, accuracy of ±5% to ±20% may be expected, depending upon the precision and stability of the signal generator and freedom from strays. This may be improved by subtracting the distributed capacitance of the inductor from the calculated capacitance value.

Some self-contained capacitance checkers of the resonant-circuit type dispense with the calculation by graduating the signal generator dial directly in picofarads and microfarads.

Capacitance sometimes is measured by this method, using a Q meter. The latter provides the tunable signal generator, accurate inductor and vacuum tube voltmeter in a more efficient circuit.

BRIDGES: The opinion occasionally is expressed that a capacitance bridge necessarily is more accurate than any other type of capacitance-measuring instrument. The assumption ostensibly rests upon the fact that the bridge compares the unknown with a standard capacitor. The statement needs qualification, however, for much depends upon the type of bridge and quality of its components. For example, a highly priced laboratory-type bridge employs highly stable standard capacitors rated

---

*** Reproduced by courtesy of the "Aerovox Research Worker."**

at 0.05% or better accuracy, and a precision potentiometer as the adjustable element. A low-cast service-type bridge intended for radio and television trouble-shooting usually contains specially selected commercial capacitors culled for ±1% to ±2% accuracy) and a volume control-type potentiometer.

The bridge circuit is important. While several types may be used for capacitance measurement, those in which a frequency term appears in the null equation (e.g., Wien and resonance bridge circuits) generally are avoided because of the need for frequency stability in excess of desired measurement accuracy. Even when the frequency is of no consequence, other factors which may introduce error include shifts in potentiometer, ratio resistors, standard capacitor, and circuit capacitances. The Schering and comparison-bridge circuits are most often used.

Capacitance Bridge. Accuracy of the laboratory-type bridge for direct capacitance measurements lies between 0.01% and ±0.25% of indicated capacitance, depending upon model and manufacture. At the other extreme is the service-type bridge, the accuracy of which is not often specified but may be found to be of the order of ±5% in factory-built models and somewhat poorer in some kit-assembled instruments. Most of the service-type bridges combine capacitance and resistance measurement.

Impedance Bridge. This Instrument combines capacitance, inductance and resistance measurements in several ranges. Its accuracy lies between ±0.1% and ±2% of indicated capacitance in factory-built instruments, depending upon model and manufacture. Impedance bridges assembled from kits may show an accuracy of ±2% to ±10%, depending upon care of assembly and calibration.

SUBSTITUTION CIRCUITS: Substitution-type measurements compensate automatically for stray and distributed capacitance, thereby eliminating error due to that source. The nucleus of the substitution circuit is a precision, direct-reading variable capacitor. The circuit, which may be either a bridge, twin-T network, or resonant tank, is adjusted first with the variable capacitor set to its maximum capacitance (C1). At this setting, the bridge or T-network is nulled, or the input to the tank is adjusted to the resonant frequency, and the unknown capacitor is not in the circuit. The unknown then is connected and the circuit readjusted by reducing the variable capacitance to a value C2 until null (or resonance) is restored. The unknown capacitance CX equals C1-C2.

Accuracy of the substitution method depends upon the accuracy of the variable capacitor. This generally is less than ±0.05%, depending upon model and manufacture. Measurements with a variable capacitor of the air-tuned type usually are limited to a maximum of 1150pF, the maximum capacitance of most precision air variable capacitors. A precision decade capacitor may, of course, be used in lieu of the air variable, with an accuracy of the order of ±0.25%.

Substitution-type measurements of capacitance often are made with a Q meter, which supplies the signal generator and direct-reading variable capacitor, together with very-high-impedance AC vacuum tube voltmeter. Accuracy with this instrument is of the order of ±1pF below a dial setting of 100pF, and ±1% above 100pF (the common dial maximum is 450pF).

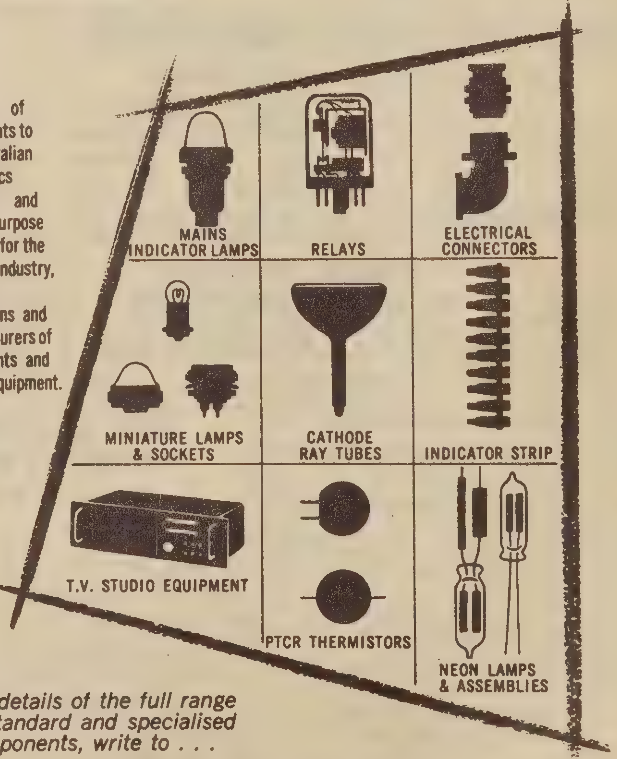
REQUIRED ACCURACY: What accuracy is actually required? This depends upon the capacitor application. Obviously, wider tolerances are allowable in some applications than in others, and this will dictate the required accuracy of measurement. For example, capacitance must be as close as possible to specified value when a capacitor is to be used in an RC or LC tuned circuit, wave filter, or timing circuit, but it may vary ±10% to ±20% (and often more) of nominal value in some bypass and coupling applications where critical time constants are not involved. Filter capacitors in power supplies also may have a wide tolerance in most instances.

In general, capacitance must be known most closely in those applications in which the capacitance directly affects a frequency, time, or phase value (tuned circuits, delay devices, timers, multivibrators, wave filters, phase shifters, critical coupling, critical bypassing, sync circuits); and less closely (but to a degree better than the specified tolerance) in those circuits which do not involve those sensitive terms (power supply filters, energy storage, non-critical bypassing, non-critical coupling, DC blocking, interference elimination).

The precision of measurement needed for the first requirement is naturally not needed for the second requirement. A useful rule of thumb is to determine the maximum error which can be tolerated in the application and then to select the instrument or measuring circuit which affords an accuracy of one-half that figure. ■

THORN
SPECIAL PRODUCTS

Suppliers of components to the Australian electronics industry, and special-purpose products for the aviation industry, research institutions and manufacturers of instruments and control equipment.



For details of the full range of standard and specialised components, write to . . .

TSP/1

THORN
SPECIAL PRODUCTS
THORN ELECTRICAL INDUSTRIES (AUST.) PTY. LTD.
HEAD OFFICE: 498 ALBION STREET, WEST BRUNSWICK, MELBOURNE.
Telephone 36 5313. Branch offices at Sydney, Adelaide & Brisbane.

Special Purchase of Manufacturer's stock of Transistors and Transistor Components enables us to offer Transistors and Kit-sets at a fraction of original cost.

Complete KIT for TRANSISTOR 6 PORTABLE $21.95

The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Packing extra. N.S.W., 10/; Interstate, 13/.

NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	5/6 ea.
XA102	OC44	Osc. Transistor	7/6 ea.
XB103	OC75	AUDIO general purpose	7/6 ea.

Ducon type SFT 123 equiv. OC74 .. .. 7/6 ea.
Available in matched pairs at .. .. 15/ pair
AUDIO OUTPUT
Post and packing on transistors 1/6 any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturers stock E.H.T. units 50/-. Deflection yokes 50/-. Post free.

NEW VALVES AT BARGAIN PRICES

1A7GT	9/6	3S4	10/	6J5	7/6	6SN7GT	9/6	1L56	9/6
1C7G	3/	5Y3GT	12/6	6K7G	4/6	6SS7 equiv. 6SK7	8/6	12A6	5/
1D8GT	9/6	5V4G	10/	6K8G	6/9	6U7G	4/6	12SK7	5/
1K5G	4/	6B8	10/	6Q7G equiv. 6B6G	10/	6X5GT	7/6	12SK8	5/
1K7G	4/	6C8G	5/	6SA7GT	9/6	7C7	3/6	12SH7	5/
1M5G	4/	6F6	10/	6SH7	5/6	12AU7	10/	866	15/
1P5G	2/6	6H6	3/6	6SJ7	9/6	12AT7	10/	954	2/6
1Q5G	2/6							955	2/6
1T4	4/6							7193	2/6
3Q4	7/6							EK32	6/9
EF50	4/6							EL33	10/

Please add postage on all valves.

NEW 4-SPEED STEREO & MONO PLAYERS

AT LESS THAN HALF PRICE

PHILIPS 4-SPEED
6V BATTERY PLAYER

MONO $9.75 £4/17/6
STEREO $11.75 £5/17/6

Post and Packing, N.S.W., 7/6.
Post & Packing Interstate 12/6 extra

NEW 240V. ELECTRIC MOTORS

3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

$2.75

NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim.
Supplied with 5in x 7in speaker in felt-lined enclosure
Space for amplifier and batteries or power supply.

$11.50

Dimensions 15in x 13in x 7in.
Post and Packing: N.S.W., 9/; Interstate, 12/.

NEW MULTIMETER — 57/6

POST EXTRA
METER 0-1MA 1,000 OHMS PER VOLT
A.C. RANGES D.C. RANGES CURRENT
SUPPLIED COMPLETE WITH TEST LEAD
RANGE 0-100,000 OHMS

0—10v	0—100v	0—500v	0—500MA
0—50v	0—10v	0—1000v	
0—250v	0—50v	0—1MA	
0—500v	0—250v	0—100MA	

EXTENSION SPEAKERS

New 9 x 6 speakers in case with volume control, 75/. Post: Interstate, 5/6; N.S.W., 4/.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping Sec. 285 x 285 with 6.3v filament winding. 60mA, 25/. Plus postage: N.S.W., 3/6; Interstate, 5/3.

Prim.: 240v, Sec. 385 x 385 at 80mA, fil. 6.3 and 5v, 27/6. Post.: N.S.W., 4/; Interstate, 7/6.

60mA H.T. Chokes, 7/6. Post.: 2/.

SHOP-SOILED 60 M.A. TRANSFORMER

285 x 285
One 6.3 volt winding 15/- each plus post. N.S.W. 5/-, Interstate 6/-.

P.M.G. PRESS TO TALK HAND SETS, 25/- each.

Post and pack 3/-.

NEW AMERICAN RECORDING TAPE

At ½ List Price

5¾in 900ft Acetate	£1/2/6
7in spool 1800ft Mylar	£2/2/6
5¾in spool 1100ft Acetate	£1/5/0
5in 800ft Mylar	£1/5/0

Post and packing, 2/6 extra.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec 225 x 225 with 6.3v Fil. Winding.

$2.75 27/6 **Postage: N.S.W., 2/6; Interstate, 4/6.**

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

$2.75 27/6 **Postage: N.S.W., 2/6; Interstate, 3/6.**

TRANSISTORISED SIGNAL INJECTOR, 55/-

A MUST FOR QUICK TROUBLE SHOOTING
Using TWO Transistors, complete with instruction sheet and battery. Post free.

NEW PER-MAG SPEAKERS by Australia's leading Manufacturer

6in Per Mag	35/
3½in Per Mag	22/6
5in Per Mag	27/6
5in x 7in Per Mag	32/6
Post and Pack, 3/6 N.S.W.; Inter.	4/6
6in x 9in Per Mag	37/6
3½in Per Mag Tweeter with Cross Over Condenser	20/
6in x 9in Per Mag Hvy. dty. 15 ohm	42/6
8in per Mag	37/6
10in per Mag	47/6
12in per Mag	67/6
12in per Mag 20 watt	135/

Post and Pack, 5/ N.S.W.; 7/6 Interstate.
12in Per Mag .. .. 67/6, Post and Packing 7/6 N.S.W., 10/ Interstate.
Speaker Transformers for above 6T, 5T or 7T 10/.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

SPECIAL PURCHASE OF FACTORY STOCK

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the manufacture of television and radio receivers and can offer same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, £4/10/ per 100. **Our Price, 20/ per 100.** Post and packing, 2/6 extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values. List price, £5/10/ per 100. **Our Price, 20/- per 100.** Post and packing, 3/6 extra.

The potentiometers are all current types and include switch pots, dual concentric and THB pots. List price, £6 per dozen. **Our Price, 25/ per dozen.** Post and packing, 2/6 extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G or IT4 as advertised on this page.

New English Miniature 11 x 1 Switches

These new miniature eleven-position single-bank switches are 1" diam. with ¼" spindle, they have silver-plated contacts and high quality insulation suitable for H.F. use.

4/9 each. Post and packing 1/6.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Crystal Pick-ups and Sapphire Styli have just been superseded. We are selling same at LESS THAN HALF PRICE. Available in STEREO at £12/15/. POST AND PACKING EXTRA N.S.W., 15/; QLD., VIC., TAS., 22/6; W.A., S.A., 39/.

HIGH-SPEED 240V. AC/DC MOTORS

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 5½in x 3½in, with 5/16in spindle 37/6

Post, N.S.W., 5/; Interstate, 8/6.

NEW 4-SPEED STEREO
PLAYER F.O.R. .. $17.50 (£8/15/)

NEW STEREO CHANGER.
4-SPEED F.O.R. .. $21.50 (£10/15/)

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 3/9

TYGAN AND SARLON SPEAKER GRILLE FABRIC

54in wide. List price $6 per yard. To clear at $4 per yard.

Postage and packing N.S.W., 3/6; Interstate, 4/6.

LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Megs Provision for crystal.
Post N.S.W. 7/6; Interstate 12/6. **£15**

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., 37/6. Post, N.S.W., 2/; Interstate, 2/. Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6. Post, N.S.W., 7/6; Interstate, 10/.

As above, 6 or 12 v., at 2 amp., 27/6. Post, N.S.W., 3/6; Interstate, 4/6. Transformer for above, 37/6. Post, N.S.W., 3/6; Interstate, 4/6.

NEW 240V. A.C. MOTORS

These small motors, size 3in x 3in x 3½in, are 1-12 h.p. but are only suitable for intermittent use. 29/6. Post N.S.W. 3/6; Interstate 5/.

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

● 3-speed 1⅞, 3¾, 7½. ● Pause control. ● Takes 7in spools.
● Simplified controls. 4 Track, £24; 2 Track £22. OSC Coils, 15/.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools.
2 Track. £17/15 $35.50. 4 Track. £22/12/6 $45.25.

NEW IMPORTED "NATIONAL" TRANSISTOR SIX PORTABLES

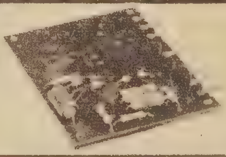
These small Portables, size 3½in x 2½in x 1½in have excellent tone and good sensitivity. Selling at less than wholesale price.

$25.75 £12/17/6 (Post free)

Supplied with leather case and earphones.

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS



Using 3 silicon transistors as featured in October, Electronics Australia complete with kit of parts including transistors mono £3/15/, stereo £6/10/, 240 power supply for above £3/10/.

NEW 17 & 25 WATT P.A. AMPLIFIERS

25 WATT .. $53.75, £26/17/6
17 WATT .. $43.75, £21/17/6
Post Extra on 15 Watt
N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air.
Too Heavy, for Post.

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms. The 25 watt amplifier can be supplied with line output transformer tapped from 100 to 600 ohms if required at 20/ extra.

Inputs provided for microphone, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt)	$6.75	67/6
Crystal Microphones for amplifier	$4.75	47/6

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

P.U. TONE
P.U. VOLUME
MIC. VOLUME
AWA
7 watt transistor amplifier

AWA

7 watt all-transistor amplifier

(AC or Battery operated)

Smartly Styled Model PA746

This amplifier is a 240 volt AC unit or a portable battery powered unit for speech and music amplification. 12 volt DC operation makes the amplifier highly suitable for all types of mobile address work. The unit also operates from a 6 volt DC supply with a corresponding reduction in audio output. The attractive case is in sturdy black armorette with polished chrome trim.

Input and output facilities

Input and output facilities are as follows: 1. Crystal Microphone input, .4 megohms. 2. Dynamic Microphone input, low impedance. 3. Pick-up input, .5 megohms. 4. Output taps are provided at impedances of 600 ohms, 200 ohms and 100 ohms.

Amplifier performance

1. Sensitivity: On pick-up approximately .5V for full output. On microphone approximately 2mV for full output.
2. Frequency Response: With tone control at normal, response is substantially level from 50 cycles to 10 Kc.
3. Harmonic Content: Less than 5% at full output.
4. Noise Level: Pick-up input better than -60db below full output. Microphone input better than -30db below full output.
5. Tone Control: Operative on pick-up channel only. Gives a smooth cut to top frequencies with a full cut of -22db at 10 Kc in maximum clockwise position.
6. Power Consumption: 12 volt operation — approximately 1.35 amps. at full load condition, quiescent current 150 MA. 6 volt operation—1.2 amps. at full load condition, quiescent current 200 MA.

Specifications

CONNECTIONS
Mains connection by plug-in power cable. Battery connection by plug-in battery cable. 6V or 12V battery selection by screwdriver switch at rear.

TRANSISTORS

Microphone Preamps.	2N217	(2)
Main Amplifiers	2N217	(2)
Push-pull Drivers	2N270	(2)
Push-pull Output	2N301	(2)
B- supply Diode Rectifiers	1N1199A	(2)

DIMENSIONS

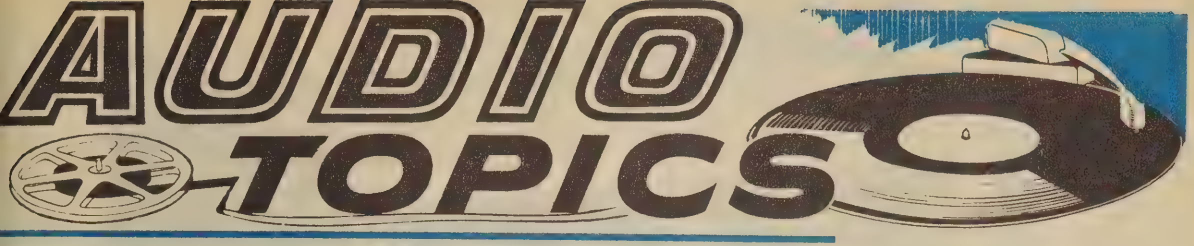
Width 5¾"
Height 7½"
Length 13¼"
Wt. 19 lbs.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

- 554 PARRAMATTA RD., ASHFIELD, N.S.W. 71 0791.
- 33 RANKINS ROAD, KENSINGTON. 33 0421.
- CNR. WILLIAM AND NEWCASTLE STS., PERTH. 28 3425-6.
- 80 CAMERON STREET, LAUNCESTON. 2 1804.
- 123 MURRAY STREET, HOBART. 3 3836-7.

Also available from:
NEWTON McLAREN LTD., ADELAIDE.
CHANDLERS PTY. LTD., BRISBANE.
ATKINS (W.A.) LTD., PERTH.
And from leading wholesalers.

AUDIO TOPICS



Comment on the U.S. audio scene

George Tillett, Technical Director of Rank-Wharfedale Ltd., spent time recently around the audio fairs and conventions in the U.S.A. He has sent us a copy of his comments and impressions, much of which has already been published in the "International Broadcast Engineer."

The 17th annual AES (Audio Enineering Society) Convention was held ecently in the New York Barbizon-laza Hotel. Two halls were devoted to n exhibition of audio equipment—nainly studio amplifiers, mixers, microhones, etc., and technical sessions were eld in the well-equipped theatre.

Each session or lecture lasted just ver 20 minutes, and there were over 00 in all, covering disc and tape reording, studio systems, loudspeakers, udio amplification and speech analysis. mong those taking part were such well-nown personalities as Dr Harry Olson, r Homer Dudley, Robert Langevin, len Southworth, Victor Brociner, Leo eranek and Decca's John Walton.

Here is a summary of some of the ost interesting:—

FIELD EFFECT TRANSISTORS N AUDIO AMPLIFIERS (D. L. Wolesen, MOTOROLA).

Field Effect Transistors (FETS) have very high input impedance—in fact is so high that the gain can be onsidered as a voltage function—as n a thermionic valve.

Mr Wollesen had this to say: "The oltage amplification factor increases as d (drain current) decreases. With this n mind the designer might be tempted o bias the drain current of the FET o a few microamperes, use a very large upply voltage and use a R load value f many megohms.

"This approach would indeed increase oltage gain, but, as with all good hings, there are certain constraints. The C load of the following stage is a onsideration; if it is an FET there is o constraint, but the loading effect of bi-polar transistor is a constraint.

"A large supply voltage allows a arger value of R to be used but it is a isky method to increase voltage gain if is in excess of the RVdgo (drain-gate reakdown voltage) rating of the FET. he limit of large signal handling apacity ability of the FET is the power upply voltage and the minimum posible drain—source voltage of the stage. he power supply voltage must be reater than the largest peak voltage wing to be encountered."

After discussing bias stabilising methds, Mr Wollesen then turned to noise onsiderations. Fig. 1 shows noise voltge versus noise resistance for a FET pe 3N124 (5, 6) a FET insulated gate pe 2N3796 (97) and a low noise silicon NP type 2N3799 compared with a 12AX7 double triode valve. The figures were taken at 1KC and it is apparent that, for high values of input resistance, the junction FET is superior to any other device now available.

In addition to this the LF noise (corner frequency? — Ed.) of the junction FET is about 15cps compared with about 100cps for a bi-polar transistor and about 400cps for the insulated gate FET. However, for source impedance less than 5K the bi-polar low noise transistor may be superior.

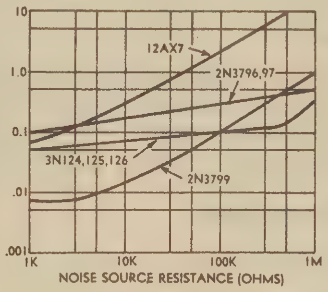


Figure 1 (above): Noise voltage versus noise resistance for a 12AX7 valve, a 2N3799 silicon transistor and two FETS.

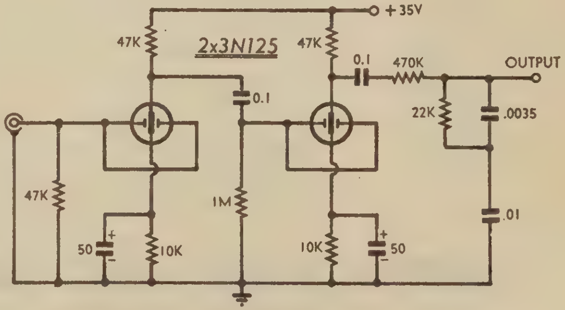


Figure 2 (right): A magnetic pickup preamplifier, using two FETS.

Fig. 2 shows the circuit of a preamplifier using two FETS with passive equalisation to RIAA standard. The gain at mid-band was given as 25. A questioner asked whether the results would be improved if a feedback loop was used to provide equalisation and it was conceded that this was so.

Other circuits were described and Mr Wollesen finished by saying that FETS show clear superiority over other devices in respect to lower noise for input resistances over 10K. "They will be used in nearly all high impedance stages and any designer who fails to consider FETS for future designs will find himself behind the times."

At the moment FETS are rather expensive but I saw several microphone preamplifiers using FETS in the exhibition. In England, STC have just released a microphone designed by M. Gayford incorporating a FET amplifier.

RECENT TRENDS IN AUDIO AMPLIFIERS (W. H. Heaven, Northern Electric, Canada).

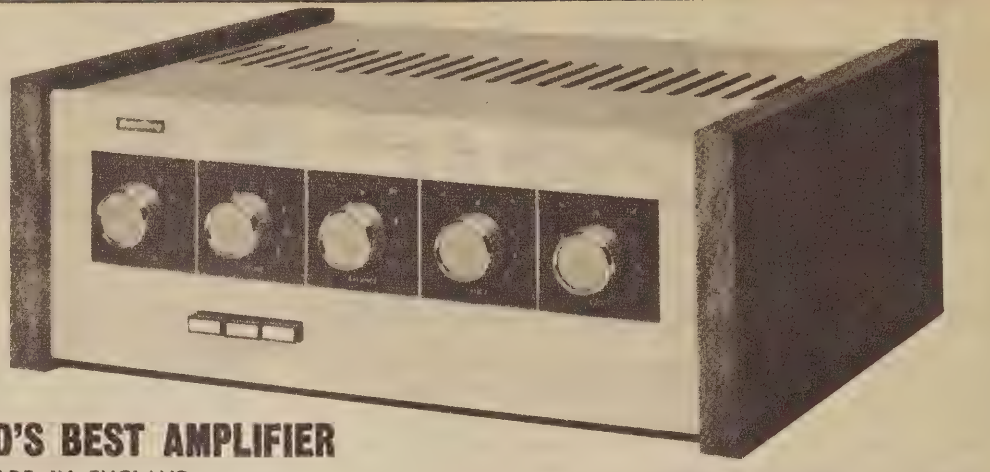
In this paper Mr Heaven discussed the merits of Darlington pairs for amplifier input stages. Fig. 3 shows the basic arrangement. The advantages are:

1. A stable circuit equivalent to a single transistor that will provide a current gain that is somewhat greater than the product of the two transistors used in the configuration.
2. When the combination is used as a single transistor in the common collector circuit the input impedance is greater than the product of the individual transistor currents and the emitter resistance.
3. The output impedance when used in the common collector circuit is low, being equal to the source impedance of the generator driving the amplifier divided again by a factor somewhat greater than the product of the current gains of the individual transistor.

These three factors alone can provide an impedance transformation greater than the square of the current gain products.

To arrive at the circuit that will provide gain with these properties a complementary pair of transistors is used, although they are not really a pair because one of the transistors must have a much higher current rating than the other as the base current of it is the emitter current of the other.

A preamplifier stage was described which uses a low noise NPN transistor plus a "garden variety" PNP type. Such amplifiers are made primarily for the broadcast industry and can be obtained with various input and output transformers.



WORLD'S BEST AMPLIFIER

MADE IN ENGLAND

Sole agents for Australia:
**TRUE FIDELITY — 23 Collins Street,
Melbourne.**

221 INTEGRATED STEREO AMPLIFIER
Shown in optional case of solid teak and vinyl-hide.

The 221 Amplifier is designed for use primarily with magnetic pickups but inputs are also provided for the higher output ceramic and crystal pickups.

At its price the 221 represents a major breakthrough in high fidelity amplifiers. Never before has an amplifier of this quality, sensitivity and power, incorporating all these facilities, been available in this price range.

It incorporates the same power amplifiers as the well-known 222 Amplifier providing 10 watts push-pull output per channel, a total of 20 watts output, but there are many additional features. The switched treble filter will reduce scratch on worn records, hiss from tape or from recorded programmes on radio, some of the interference on the medium waveband and other high frequency distortion encountered, on occasions, from all sound sources. The tape monitoring facility enables the signal being recorded to be monitored direct from the tape, where the tape recorder has a monitor output. The loudness control superimposes an increase in the extreme bass and treble on the otherwise flat response, to compensate for the relative insensitivity of the ear to these frequencies at moderate to low volume levels.

As well as these special features the 221 Amplifier has all the facilities required for the complete high fidelity system. Five pairs of inputs provide for all sound sources and the input sockets are automatically switched, so that plugging in a mono sound source to one channel automatically provides a dual output from both amplifiers. The mono and stereo recording outputs are suitable for use with virtually any tape recorder. The switched rumble filter will eliminate turntable rumble where this is troublesome. To match the 221 there are the 223 AM-FM Tuner and 224 FM Tuner, and all are available with or without the attractive shelf-mounting cases of teak and vinyl-hide.

TECHNICAL SPECIFICATION

The specification refers to overall performance and this should be borne in mind when comparing figures with amplifiers and control units quoted separately.

Power Output	10 watts push-pull per channel, R.M.S.
Frequency Response	30-20,000 c.p.s. ± 1dB.
Power Response	35-20,000 c.p.s.—1dB.
Harmonic Distortion	Less than 0.5% at 1K/cs measured at 8 watts output ± 1dB.
Hum and Noise	55dB below rated output.
Negative Feedback	15dB.
Output Impedance	Alternative 4, 8, 16 ohms.
Transient Response	Rise time 6 micro-secs.
Crosstalk	Better than 40dB.
Channel Matching	± 1dB.
Balance Control	Range of—10dB each channel
Treble Control	+ 15dB.,—12dB, at 10K/cs.
Bass Control	+ 12dB,—12dB, at 70 c.p.s.
Loudness	Switched. Superimposes increase in extreme bass and treble at low volume.
Rumble Filter	—6db at 35 c.p.s. increasing at lower frequencies.
Treble Filter	8 K/cs. with slope of 12db per octave above this frequency.
Input Sensitivity	Five pairs of stereo inputs as follows: Pickup 1, Tape, Radio. 80mV at 2M ohms. Pickup 2 (magnetic pickups) 3.5mV at 50K. Tape Monitor 600mV at 100K.
Tape Recording	500mV output. Low impedance.
Valves & Semi-Conductors	4 x ECL86, 2 x ECC83, 2 x AC107, 2 x OC71 2 x BY114.
Power Supplies	AC 200-250 volts. Dual voltage (100-130, 200-250 volts) to order. Consumption 70 watts.
Weight	Net. 14½ lbs, 6.6 kgs. Packed 19 lbs, 8.6 kgs.

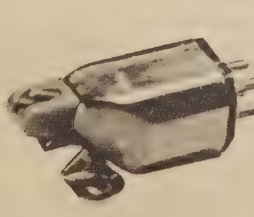
Dimensions		Width.	Depth.	Height.
Chassis	ins.	12⅜.	10⅝.	4¾.
	cms.	31.4.	26.9.	12.
In Case	ins.	13⅜.	11.	5¼.
	cms.	34.0.	27.9.	13.4.
Cut-Out	ins.	12⅛.	—	4½.
	cms.	30.8.	—	11.4.

EMPIRE — WORLD'S MOST PERFECT MONO-STEREO CARTRIDGE

Manufactured in U.S.A. Sole Agents for Australia — TRUE FIDELITY

EMPIRE'S
EXCLUSIVE MAGNETIC
CONE STYLUS*

LIGHTEST MOVING
MECHANISM YET DEVELOPED
DYNAMIC MASS LESS
THAN .5 x 10⁻³ GRAMS



EMPIRE'S EXCLUSIVE CONE STYLUS*

LIGHT MOVING MECHANISM DEVELOPED DYNAMIC MASS LESS THAN .5 x 10⁻³ GRAMS

*** U.S. Patent 2875282**

Sole Agents for Australia

TRUE FIDELITY

(C. PINCZEWSKI)

RECORDED MUSIC SALON **23 Collins Street., Melbourne—Telephone 63-6257**
WHOLESALE AND TRADE ENQUIRIES WELCOME

ARTIFICIAL VOICE (Dr H. Olson, CA).

This is the term used to designate a udspeaker system which exhibits acous- characteristics similar to the human ice. Dr Olson said, "There are many plications where this is a need for an tificial voice for tests of microphones d rooms for pick-up conditions and stances of the kind and magnitude nployed in speech reproduction in dio, television, sound motion pictures, sc recordings, etc.

For these applications the acoustic npedance of the artificial voice is not o important. However, it is quite nportant that the directivity pattern be e same as the human voice in order at the ratio of direct to reflected sound preserved. In addition the artificial oice should exhibit high quality per- rmance both from the standpoint of equency response and non-linear dis- rtion characteristics.

"An artificial voice of this type may driven by a higher quality tape repro- icer."

Dr Olson went on to say that it is ossible to use the "voice" for A-B icrophone tests, and for articulation sting of microphones under operating onditions. Thus it is possible to dupli- te the performance of the "speaker" ch and every time the program is ayed, as contrasted to the difficulties obtaining similar repetitions by a live rformer.

After describing the construction, Dr lson said the correlation between the equency characteristics and directivity dicated a very close agreement with e human voice and artificial voice. he bass speaker has a 4in cone and e diameter of the treble unit cone is st under 1in.

The cross-over frequency is 1,500cps nd a coupler is used to connect the w frequency speaker to the 2in mouth pening. Two ¼in holes are located in e shoulder and connected to the chest vity to simulate the human voice echanism, which transmits some low equency components through the chest.

AN ULTRA COMPACT LIGHT-EIGHT SPEAKER SYSTEM (W. lliott, Sonocolor, New York).

Mr Elliott has been engaged in deve- ping inexpensive speaker systems suit- ole for connecting to domestic radio- ams, tape recorders, etc. After saying at the cost must not exceed $25 retail, r Elliott said, "For reasons of bulk on ie hand, and cost on the other, closure tests soon ruled out both the iss-reflex and the totally enclosed types.

"The most promising designs occurred nong these combining horns and direct diation. The voice coil circuit and echanical network of a typical system e modified from those of Olson in his isic 1957 treatise on acoustical engi- ering. Consideration of space and effi- ency provided sharp variations which re subjected to further testing."

One design in particular gave a highly icient output with reasonably smooth sponse from 80 to 10,000cps and addi- nal coverage from 50 to 15,000. Maxi- um smoothing is obtained by the nployment of acoustic resistance filters the face of the direct radiator, the ouths of the two final horn flare paths d the tweeter aperture, consisting of a id plastic plate with ¼ inch round les. A final improvement is possible through elimination of sharp bends and a general rounding of the internal horn path to provide a smoothly expanding flare.

While the final formulations for enclosure design and drivers were being worked out, a simultaneous search was under way for improved structural materials for the enclosure. Prototype models were constructed of celotex, fibreglass and styrofoam, as well as combinations of these with plywood.

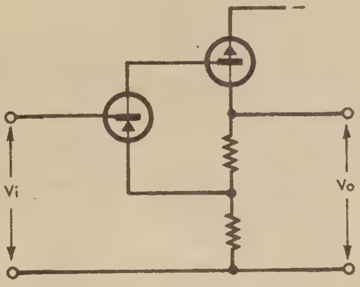


Figure 3: A Darlington pair using PNP and NPN transistors.

The use of styrofoam gave desirable non-resonant features because of the unequal granular composition of this plastic, but presented certain problems of fragility. Testing was then centred on "Uvex" a cellulose acetate butyrate compound. The speakers selected were a 8in bass unit plus a 3¼in tweeter and the complete system weighs less than five pounds. The depth is less than four inches.

Two of these systems were demonstrated, but it was difficult to judge the quality as the pick-up appeared to be faulty and the distortion was high. However, coloration seemed to be quite low —as might be expected.

A MATHEMATICALLY DEVELOPED LOUDSPEAKER (L. Walsh), Walsh Engineering, Millington, N.J.).

Mr Walsh said: "One of the main degrading factors in loudspeaker performance is the lack of diffusion which is the ability to transmit the same high quality voice or music to all points where a listener's ears might be located. The objective of the whole communication or recording system is to reproduce at the listener's ears the same sound that exists at the microphone.

"There are many variable factors that intervene, some controllable and some not, and some compensation may be made for some of these factors, such as loudness compensation for lower volume. But the inability of a loudspeaker to deliver the same high fidelity of music and voice to all points in the listening area is a factor that cannot be compensated.

"The practical matter of moving air in sufficient volume for good performance at low frequencies requires a dia-

ABOUT AMPLIFIERS:

As far as amplifiers are concerned, the trend toward silicon transistors is now firmly entrenched and I doubt whether there will be any American amplifiers using germanium transistors next year. The reason is simple — silicons are more robust, have lower leakage and wider frequency range than their germanium counterparts.

Until recently they have been rather more expensive, but prices dropped with a bump a year ago and there has been a rush to change over. Thus, in the advertising sense, the emphasis is on silicon transistors with Sherwood, Scott, Acoustech, Altec, etc., all preaching the same theme.

How is this swing over to silicons affecting circuit design? Early germanium amplifiers had a DC line of 40 volts or so which was really determined by the ratings of the transistors themselves. Without going into technicalities, this means in a conventional transformerless output stage 4 power transistors have to be employed instead of 2, if more than 15 watts is required. Furthermore, they would have to be driven by transformers with the disadvantage of poor stability and frequency response. So early transistor amplifiers were not only handicapped by transistors with a poor frequency response, but they could not realise the full advantages of transformerless design.

True, the power drift type of output transistor with its vastly superior high frequency performance went a long way to improve matters — but there was still that driver transformer to contend with. The result was that many of these amplifiers were not stable enough to work with electrostatic and other systems, and the distortion increased at low levels — say, below 3 watts. But now with the advent of reasonably priced silicon driver and output transistors in the 80 to 100 volt class the driver transformer can be scrapped in favour of direct coupling.

A modern transistor amplifier can have a wider frequency range, better transient response — in fact, a better all-round performance than its valve equivalent. This does not mean that thermionic valve amplifiers are dead yet — Marantz and one or two smaller specialist firms are still making them and McIntosh are not yet converted although they use transistors in their preamplifier. Avery Fisher told me that they still find a fair demand for valve amplifiers.

ABOUT LOUDSPEAKERS:

American speaker systems, like their hamburgers, come in all shapes and sizes, but easily the most popular size is about 25 by 14 by 14in. Given this basic shape there isn't much that can be done to distinguish one from the other and so the systems in this class tend to look alike. A favourite combination is a 12in low resonance woofer with 5in mid-range plus a 3in treble speaker or pressure unit. Generally speaking, the Americans prefer a solid bass with a forward sounding mid-range, while we on this side of the Atlantic prefer a more unobtrusive sound. There is evidence, however, to prove that our tastes are becoming increasingly similar and the best British and American speakers tend to sound more and more alike.

Incidentally, I heard the Acoutech X10 system and I was most impressed. What is the X10? It is a stereo system comprising two 7ft electrostatic speakers with built-in matching amplifiers and sells at around $2,000 with preamp. Not exactly cheap but, as I said, the results were certainly impressive.

"LOVE LETTERS"

MR S. C. ROWELL

Mr. Rowell is extremely well known amongst Melbourne enthusiasts and music lovers and belongs to the no-compromise school of high-quality sound reproduction. To say, that he is a most discerning and critical listener would be an understatement and we are therefore very proud to have received this completely unsolicited letter.

6 Winmalee Road,
BALWYN, VICTORIA.
January 10, 1966.

Dear Sirs,

I have always attached the very greatest importance to the pick-up and turntable of my high quality record playback equipment, and I am pleased to tell you, that the new ADC-10/E cartridge, which I am now using, is absolutely magnificent. (My previous choice was the ADC Point Four E). In my search for perfection, I am constantly comparing and auditioning every high-grade pick-up, as it appears on the market, apart from continually hearing a great deal of live music. I am fully convinced, that the new ADC-10/E is, by far, the finest cartridge currently available anywhere and so is everybody else, who has heard it; there is no doubt in my mind, that its audible performance will become the new standard, by which all other stereo cartridges will be judged.

I would certainly advise anyone interested in CLEAN reproduction to try this remarkable head on "tough music" and work it hard on something complex, such as opera, piano, choral, or any recording, where the pickup has a REAL job to do. The manufactures' claim, that no one will ever make a cartridge, that performs perceptibly better is fully justified. It traces superbly at ½-¾ gm in the Pritchard or SME arm.

For the last two years, I have used your J. H. SYNCHRONOUS TURNTABLE and it functions perfectly. Rumble, wow and flutter are non-existent, which is a lot more than I can say about other brands costing two or three times as much. I can truthfully state, that I would not exchange your turntable for any other make.

Yours faithfully,
S. C. Rowell

J. H. REPRODUCERS PTY. LTD.

199 WAVERLEY ROAD, EAST MALVERN, VIC., TELEPHONE: 211-5149

Exclusive Australian Representatives for A.D.C., U.S.A. and Makers of the J.H. Synchronous Turntable and J.H. Pickup Arm phragm whose diameter is equal to a number of wavelengths of the highest frequency sound to be reproduced. This number would be a minimum of about ive in a 5-inch loudspeaker and it might be 15 in larger loudspeakers.

"With the diameter equal to five wave-engths of the highest frequency, the otal angular width of the beam of optimum quality is slightly less than x sin ⁻¹1/5 or approximately 20 legrees. This is assuming that the dia-phragm is acting as a rigid piston, but his never happens. Cone 'break-up,' as t is called, widens the beam of optimum quality, but breakup is unpredictable and it is not subject to analysis . . .

"The theoretical concept of the new oudspeaker is that a conical diaphragm, mounted with its axis vertical, can be designed to generate sound waves that are cylindrical or nearly spherical. Furthermore, the new loudspeaker in the theoretical concept can be designed o have a uniform response over any desired range of audio frequencies."

Mr Walsh went on to say that "A conical diaphragm is a simple thing in both appearance and in manufacture. But its modes of vibration at any of the frequencies in the audio range are xtremely complicated. It is not a piston ven at the lowest audio frequencies. The vibratory modes do not lend them-elves to direct calculation, but there re methods of obtaining a useful nalysis."

Introduced at the Los Angeles High Fidelity show by Stanton Magnetics Inc., this "Longhair" cartridge carries its own dust-removing brush, precisely pivoted so that it has a downward thrust on the record surface of 1 gram. Weight on the stylus tip is the total tracking weight provided for the head, less one gram. (Details from Ad Auriema Inc., 85 Broad St., New York 4, N.Y., U.S.A.).

To obtain the necessary performance onditions, the conical diaphragm of the ew speaker is treated as a mechanical-ave transmission line with the wave nput at one end. The speaker is mount-d vertically and the cone material, actu-lly aluminium foil-covered plastic, is rranged to give a spherical wavefront. he speaker is mounted on a box some in deep by about 12in square filled ith damping material to absorb the rontal wave." In practice, of course, e absorption would only be partial, ut when these speakers were demon-rated the bass seemed to be quite ood.

The omni-directional characteristic oduced a poor stereo image in the irly large hall (as might be expected) d overall quality was difficult to assess e to the rather poor demonstration.

Control room of the Gamba Recording studios, operated by Derek E. Jolly Services Pty. Ltd., at Deccas Place, 97 Melbourne St., North Adelaide, S.A. Gamba discs are produced from this centre, also tapes for the "Sound and Image" presentations, as at Bonython Hall, University of Adelaide and the Adelaide Festival of Arts.

A SOLID STATE HIGH FREQUENCY COMPRESSION HORN (H. Schafft, Motorola).

This is a horn-loaded high frequency speaker using a Piezo-Ceramic (PZT) driving element.

Mr Schafft described various methods of using PZT elements as audio devices. Three "driving modes" were analysed—thickness, transverse and shear. A modified transverse mode using a length expander was adopted as being the best compromise in respect to sensitivity, driving voltage, impedance, etc. The length of the ceramic tube element was fixed at 2.5in to act as a ¼-wave resonator at 12KC; the diaphragm is made from aluminium and has an elliptical taper to provide the necessary stiffness. The horn itself is made of plastic and is about 10in long. The frequency response shows a gradual rise from 2KC to 10KC, thence falling fairly rapidly to 20KC. The shape of the curve is caused by the falling impedance characteristic and the response at the extreme high end determined by the driving system which becomes mass-controlled above 12KC.

STYLUS MASS AND ELLIPTICAL POINTS (John Walton, Decca).

John Walton had this to say: "There has recently been a trend for the minority of the better pick-ups to be fitted with elliptical styli in order to reduce the geometric distortion of tracing . . .

"There is an indication that the fitting of elliptical styli has, in practice, even in that minority of better pick-ups, not necessarily resulted in any significant reduction of distortion and can even result in more. A more unexpected result was the observation of certain conditions involved in the production of 'modulation noise' from disc."

After reviewing various types of distortion and methods of measurement and assessment, Mr Walton concluded as follows:

"1. The complex nature of the effects of stylus radius make it necessary to measure distortion over a wide range of frequencies and levels before assessing the merits of increasing or decreasing the effective stylus radius.

"2. The method of measuring distortion as harmonic amplitudes displayed upon a harmonic analyser is well suited to this task.

"3. The fitting of an elliptical stylus to most pick-ups at present will result in more distortion—not less. Only those pick-ups with a measured effective stylus mass in the region well below 1 mgm can benefit by a 0.0003in minor radius, and the present radius of 0.0005in seems best suited to the majority of average good pick-ups with their stylus masses in the 1-2 mgm region."

SUMMING UP: I thought it a pity that the time allotted was so restricted—most speakers were a little disconcerted at the apparent premature sound of the bell! Nevertheless, a most interesting five-day session. A complete set of Pre-Prints can be obtained from: A.E.S., P.O. 383, Madison Square Station, New York, price $US12. ■

BARGAIN
SALE

- Valves
- Pots
- Resistors
- Condensers
- P.M.G. Relays
- Switches
- Meters
- Diodes
- Aluminium Tube and sheet
- Radio and Radar Disposals.

INSPECTIONS INVITED
Open Saturday Morning

WRITE OR CALL FOR FREE Price lists to:

HARE & FORBES PTY. LTD.
180 George Street.
PARRAMATTA, N.S.W.
635-9947 — 635-6096

NAME ....
ADDRESS ....
....
PLEASE PRINT CLEARLY

Outstanding Offer from Reader's Digest - RCA

"The Magical World of Melody'

12 Magnificent Reader's Digest-RCA 12" recordings—
A Treasury of 170 of the World's most beautiful melodies.

HUGE 50% DISCOUNT SAVES YOU $33.00

(£16-10-0)

and you may play the full set in your own home

FOR TEN DAYS FREE

ENJOY, in your own home, 170 of the world's most beautiful melodies, "Pleasure-Programmed" to bring you nine hours of listening enjoyment. If you decide to keep the set—the HALF-PRICE SAVES YOU $33.00 (£16-10-0) AND YOU MAY PAY ONLY $4.50 DEPOSIT with six monthly instalments—INTEREST FREE.

Here are some of the contents of this set:

IRVING BERLIN: There's No Business Like Show Business · Easter Parade · Cheek to Cheek · Remember · Blue Skies · A Pretty Girl is Like a Melody · Always.

BIZET: Carmen Suite

GEORGE GERSHWIN: Fascinatin' Rhythm · Someone to Watch Over Me · S'Wonderful · Embraceable You · A Foggy Day · I Got Rhythm · Rhapsody In Blue Theme.

RICHARD RODGERS: The Sweetest Sounds · Where or When · Bali Ha'i · Lover · With a Song In My Heart · Falling in Love with Love · My Funny Valentine.

PUCCINI: La Bohème Suite

FRANZ LEHAR: Merry Widow Waltzes · Vilia · Gold and Silver Waltz · Yours is My Heart Alone · Where the Lark Sings.

OFFENBACH: Gaité Parisienne

DUKE ELLINGTON: Mood Indigo · Sophisticated Lady · I've Got it Bad and That Ain't Good · Solitude · Caravan · Prelude to a Kiss · In a Sentimental Mood.

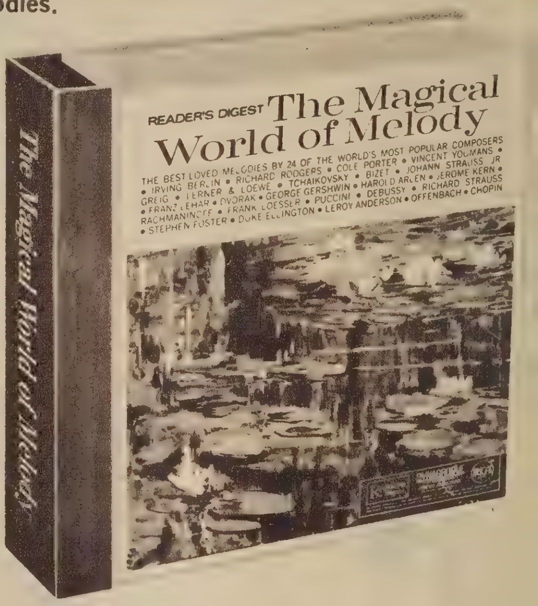
TCHAIKOVSKY: Theme from Symphony No. 6 · Romeo and Juliet Theme · Swan Lake Waltz · Piano Concerto Theme · Humoresque · Theme from Symphony No. 5—*others.*

CHOPIN: Les Sylphides

COLE PORTER: Night and Day · I Get a Kick Out of You · Let's Do It · In the Still of the Night · It's Alright with Me · Just One of These Things.

JEROME KERN: Lovely to Look At · I've told Every Little Star · Smoke Gets in Your Eyes · The Way You Look Tonight · The Song is You · All the Things You Are.

And the best-loved music of Harold Arlen, Vincent Youmans, Lerner and Loewe · Frank Loesser · Leroy Anderson · Rachmaninoff · Grieg · Debussy · Richard Strauss · Johann Strauss Jr. · Dvorak and Stephen Foster.



The Magical World of Melody
READER'S DIGEST The Magical World of Melody
THE BEST LOVED MELODIES BY 24 OF THE WORLD'S MOST POPULAR COMPOSERS • IRVING BERLIN • RICHARD RODGERS • COLE PORTER • VINCENT YOUMANS • GRIEG • LERNER & LOEWE • TCHAIKOVSKY • BIZET • JOHANN STRAUSS JR • FRANZ LEHAR • DVORAK • GEORGE GERSHWIN • HAROLD ARLEN • JEROME KERN • RACHMANINOFF • FRANK LOESSER • PUCCINI • DEBUSSY • RICHARD STRAUSS • STEPHEN FOSTER • DUKE ELLINGTON • LEROY ANDERSON • OFFENBACH • CHOPIN

FULL PRICE ONLY $33.0

(£16-10-

ONLY $4.50 Deposit with six monthly insta ments of $4.75 each — *Interest Free.*

This 12-Record Set is presented in this craftsma made album which has been designed to last lifetime.

FREE! 24-page booklet. This is a 24-page guid written by a distinguished musicologist, describing ma of the musical adventures of the great masters whos work is represented in the set. It is included with yo set at no extra charge if your order form is maile promptly.

FREE! 12" LP Record. If your order is received b us within the next 12 days, we will enclose with you set an additional 12" LP entitled "Continental Waltzes which is yours free provided you decide to keep you set of "Magical World of Melody" after playing it f ten days free.

SEND NO MONEY

To reserve your set for ten days free trial, cut out coupo below and mail to Reader's Digest, Box 65, G.P.O., Sydne

CUT OUT ALONG DOTTED LINE

To: Reader's Digest Association Pty. Ltd.,
Box 65, G.P.O., Sydney.

YES, I accept your offer. Please send me a set of "The Magical World of Melody" for 10 days free trial. Please enclose my FREE LP and booklet.

NAME ....

ADDRESS ....

.... STATE ....

I understand that if I am not completely satisfied, I may return the set within 10 days and owe nothing.

Classical reviews

By JULIAN RUSSELL

Stravinsky: A Bargain Set

STRAVINSKY—Firebird; Petrouchka; Rite Of Spring. Columbia Symphony Orchestra conducted by Igor Stravinsky. C.B.S. Stereo S3BR2 2 0015. (Three 12in discs in box.)

Musically, I suppose these three balets are among the greatest ever written. he only ones of comparative stature re the big Tchaikowsky entertainments hich were unadventurous musically, hough wonderfully inventive melodiclly. And there is, of course, Ravel's Daphnis And Chloe," which must lways remain in the front rank.

Their balletic material apart, the three travinsky ballets in this set show the xtraordinary development of a youngish omposer. First there is the romantic, airy-tale atmosphere of "Firebird," nelodious, glittering in its orchestration, nd the work of an already secure maser of his medium.

"Petrouchka" leaves this lusciousness ehind for an exercise in realism, its tory a bitter comment on the fate of n inarticulate but sensitive soul, its nusic a summing-up of the Russian folkong school, its material used in a highly ndividual manner. Its energy is stounding, the motivation of its characers deftly observed by a compassionate ystander. It is a complete work of rt appealing equally to the eye, ear nd intellect.

"The Rite Of Spring" takes us into he area of pre-history. Its story is agan, its music savagely expressive of rimitive emotions. Musically, it is peraps the greatest of the three, but horeographically it presents problems hat have, even today, never been satisactorily solved. It remains obstinately work for the ear rather than the eye nd, for my part, can be enjoyed in a oncert hall, or on records, more than in theatre.

All three of these ballets have previusly been issued separately. This time hey are offered as a boxed set at the ut price of £7/7/ and for those who ave not yet acquired any of them they epresent a bargain. Generally speaking, he standard of performance is very high ndeed, the orchestra plays enthusiasticlly for the veteran composer-conductor, hose interpretations, whatever one's ersonal opinion, must be taken as defiitive.

I returned to them after a lapse of ome years astonished at the freshness f Stravinsky's invention, delighted with he refinement of the performances and eguiled by the sheer technical wizardry f the scores. Stravinsky insists on perection of detail, all of it made easily udible by the clarity of the recording. But this perfectionism never becomes niggling. The broader aspects of all three works are never sacrificed. All three move relentlessly to their destination. The many rhythmic novelties have lost none of their vigour. They can still quicken my pulse though I have known all three ballets since I was a boy.

Stravinsky was pushing 80 when he re-recorded them for Columbia about four years ago and much of the hard work at the rehearsals was carried out by his young disciple, Robert Craft, under Stravinsky's supervision. It was he who got the orchestra note perfect before the master himself took over. I had the interesting experience of attending one of these rehearsals when Stravinsky toured Australia with Craft in 1961. Under Craft, the works remained interesting exercises, but when Stravinsky himself took over they fairly burst into bloom.

And this was not a matter of a change of phrasing here and added accent there, or a slight alteration in the balance of various departments of the orchestra. Something inexplicable happened. It was as if one had seen the incredible—a statue brought to life under one's eyes. Marble became flesh, muscles frozen into a pose suddenly became supple and a complex structure of nerves seemed to function, alert to every outside stimulus. The music not only seemed to breathe, it suddenly acquired self-direction, a purpose, a destination.

I am not exaggerating when I say that I recaptured all these thrills on replaying the three great ballets. The performances are completely lifelike. Stravinsky's readings are authoritative but never dictatorial. And his interest in these early works seems to have remained unimpaired. There is never a hint of condescension in his approach to these products of a faraway youth, though Stravinsky himself has admitted recently that some passages he has tried to rewrite have still eluded his more mature powers of self-expression. The "Princess's Dance With The Golden Apples" is an example of a sequence still unsatisfactory to the composer, who describes it as "Mendelssohnian." But, one might ask, what's wrong with Mendelssohn, anyway?

To me, the pages Stravinsky disapproves of are miracles of delicacy and refinement, their harmonies free beyond Mendelssohn's most extravagant imaginings, the rhythms infectiously resilient. And I must repeat, at the risk of boring reiteration, that this same freshness persists in every bar of all three ballets. I recommend the set with the greatest possible enthusiasm.

BRAHMS—Lieder Recital. Dietrich Fischer-Dieskau (baritone) and Gerald Moore (piano). HMV Stereo OALP 2083.

Those who know Brahms' appearance only from the bearded portraits of his late middle age will be astonished at the picture of the sensitively featured, almost girlish-looking boy that appears on the sleeve of this delightful disc. And I think they will also be surprised at the beauty of many of the very early songs recorded here. More than a few, in Opus 3, Opus 6 and Opus 7, might be fairly described as unknown to contemporary recital-goers, so firmly have the later ones established themselves in the repertoire at the expense of these less mature, but still lovely lieder.

True, several of them are sentimental in a way that, taken in large doses, might end by cloying. But there is enough variety of mood in others to avoid monotony, always provided that all but professional singers bent on study take them in discreet quantities. There are, in all, 18 songs in this recital, some of them very early indeed, probably dating back to the time the young composer was making a living playing the piano in sailors' dives in his native city of Hamburg. Others, the nine in Opus 32, show him at the more mature age of 30, and well on the way to mastery of his medium.

Those who always look to Fischer-Dieskau for a very high standard of performance will not be disappointed. His style is as faultless as ever, his phrasing and breath control peerless, his identification with the music complete. Now and again a trace of dryness can be noticed in his voice, in an occasional mezza voce note, and also a tendency for the quality of the tone to narrow at the top of his unusually wide range.

But these are only momentary lapses that did little to impair my enjoyment of a charmingly fresh, expressive, and easy-to-listen-to concert. And there is, too, accompanist Gerald Moore to supply the singer with incomparable support. It must be a relief to many who recently read of Moore's intention to retire from the concert platform to learn that he does not propose to curtail his activities in the recording studio.

★ ★ ★

CALLAS SINGS ROSSINI AND DONIZETTI. Rossini — Arias from La Cenerentola; William Tell; Semiramide. Donizetti — The Daughter of the Regiment; Lucrezia Borgia; L'Elisir d'Amore.
With the Paris Conservatoire Orchestra conducted by Nicola Rescigno. Columbia Stereo SAX02564.

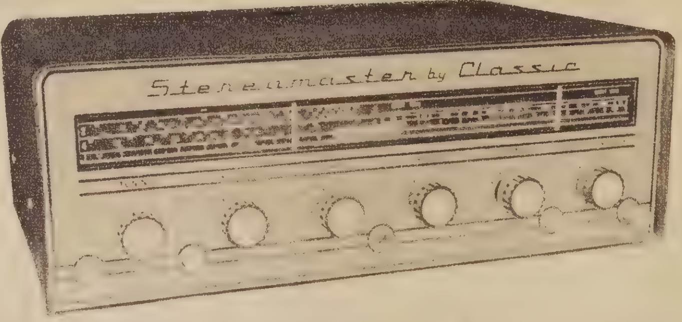
The measure of Callas' extraordinary gift for characterisation is demonstrated in these arias which, on the surface, offer little evidence of furnishing material for that art. Yet Callas makes of each a separate entity, the whole character of her voice and personality changing from song to song. Singers might note that many of the arias can be successfully delivered by a mezzo-soprano, which is perhaps an indication that Callas is about to avoid in future those roles which call for smooth handling above the stave, a problem that she has never quite succeeded in solving satisfactorily.

There is occasionally a fiercely attacked top note even here but fewer than would occur in a recital devoted en-

HI-FI STEREO EQUIPMENT BY CLASSIC

Based on Radio & Hobbies Playmaster No. 4 and Playmaster 101 Amplifiers. Both units have built in dual wave tuners.

WRITE
FOR
FULL
SPECIFICATIONS



ALL
UNITS
FULLY
GUARANTEED

SPECIFICATIONS COMMON TO BOTH UNITS:

● Inbuilt high gain dual wave tuner with a frequency coverage of 550 to 1,600 K.C. on the broadcast band and 16 to 49 metres on short wave. ● EM84 tuning indicator giving accurate tuning with ease. Two channel tone control stage with separate bass and treble controls. ● Input facilities with switching for external tuner—stereo pick-up—stereo or mono tape recorder for recording or play back. ● Stereo reverse switch. ● Calibrated dial scales available for all States showing main stations in large type with separate scale for short wave using two dial pointers. ● Chassis is mounted in attractive and durable metal case finished in grey with embossed control panel in black and silver with matching knobs.

PLAYMASTER 4 UNIT WITH TUNER

- Output 8 watts per channel (16) watts.
- Incorporating Ferguson grain oriented output transformers giving response of 20 to 30,000 cycles.
- Valves, 4 6GW8, 12AU7, 6N8, 6AN7, EM84, and two IN1763 rectifiers.

AMPLIFIER AND TUNER $105.50, WITH GARRARD AUTOSLIM STEREO CHANGER AND TWO MAGNAVOX 8WR SPEAKERS. **$139.00 (£69-10-0)**

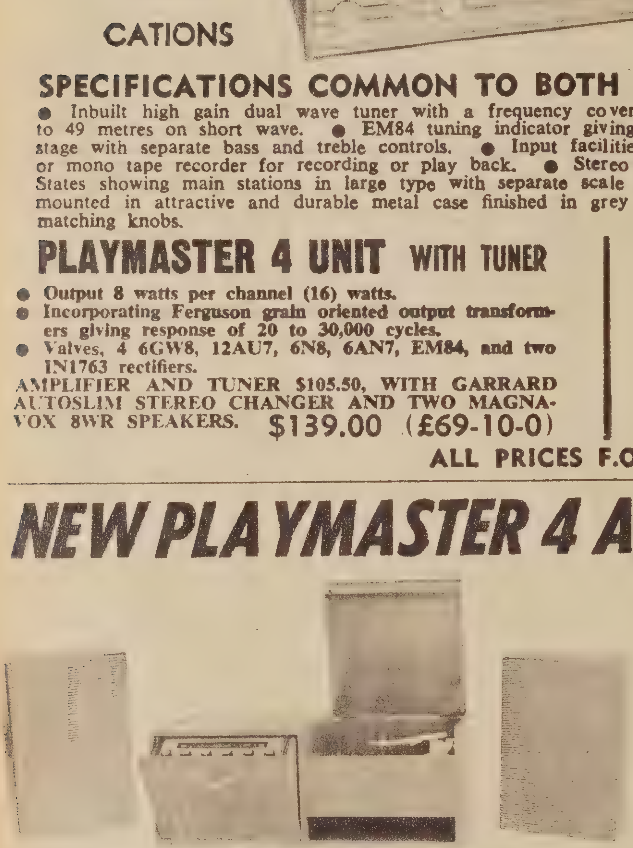
PLAYMASTER 101 UNIT WITH TUNER

- **Output 12 watts per channel (24 watts).**
- **Incorporating Ferguson grain oriented output transformers giving a frequency response of 20 to 30,000 cycles.**
- **Valves 4 6GW8, 12AX7, 6N8, 6AN7, EM84 and two 210 rectifiers.**

AMPLIFIER AND TUNER $113.00. WITH GARRARD AT5 STEREO CHANGER AND TWO ROLA 12PX SPEAKERS, $159.00 (£79/10/0).

ALL PRICES F.O.R. SYDNEY

NEW PLAYMASTER 4 AMPLIFIER with TUNER



COMPLETE STEREO SYSTEM

- Playmaster 4 amp with tuner.
- Garrard Autoslim Changer.
- 2 Playmaster Bookshelf Speakers.
- Control Cabinet as illustrated, in Maple, Rosewood, or Walnut.

Teak $7.00 extra. Legs for Control Cabinet if required, $2.50 extra.

$216.00 Freight and packing extra.
(£108-0-0)

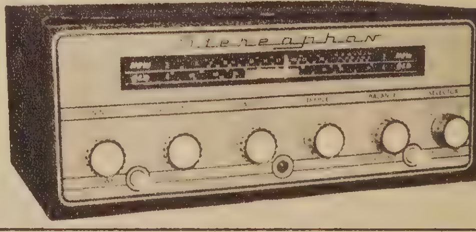
Amplifier and Tuner supplied with two Magnavox 8WR or Rola 8MX speakers and Garrard Autoslim record changer.

(£63-15-0) $127.50 F.O.R.

- Output 8 Watt per Channel (16 Watts).
- Ferguson O.P.412 Oriented Grain Output Transformers with a frequency response of 20 to 30,000 cycles.
- Inbuilt Tuner with EM84 Tuning Indicator, Calibrated Dial Scales.
  Available for all States.
- Valves 4-6GW8, 12Au7, 6N8, 6AN7, EM84 and 2-210 Rectifiers.
- Switching and Input Facilities for Pick-up and Tape Recorder (Stereo or Mono).
- Supplied in self-contained case finished in grey baked enamel with Control Panel in black and silver with matching knobs.
- Fully Guaranteed.

AMPLIFIER and TUNER

(£46-15-0) $93.50 Plus Freight



CLASSIC RADIO

245 PARRAMATTA RD.,
HABERFIELD, N.S.W.
Telephone: 71-2145

tirely to arias written exclusively for a dramatic soprano. The fact that she recently sang Carmen so spectacularly—when is she not spectacular? — also encourages speculation that she intends to move into the high-mezzo range. But with Callas such prophecies are usually fruitless, especially when it is remembered that, in addition to her many other roles in Italian operas, she has also sung Isolde.

The recital generally is uneven in quality. Some of the coloratura passages are not quite as fluent as they might be, though others are exemplary, and her tone, again only sometimes, deteriorates at the extremes of her register. But these are features her admirers have always resolutely ignored, such is their pleasure in her more positive virtues. Students should find her interpretative powers well worth close study. No other soprano singing today can get herself into the skin of a role with so little preparation. Opera lovers might find the record attractive for the comparative unhackneyed nature of many of the arias. Indeed, one of them, "Com'e Bello! quale incanto," from "Lucrezia Borgia," is not available, so far as I could learn, in any alternative version.

* * *

BERLIOZ — Symphonie Fantastique, Op. 14. Paris Conservatoire Orchestra conducted by Ataulfo Argenta. Ace of Diamonds Stereo SDDA115.

French orchestras are well known for their reluctance to rehearse works they consider they know well, even under conductors with whom they are unfamiliar. No matter what new ideas this conductor may have to communicate they are usually received tepidly, sometimes with downright rudeness. For instance, at a recording rehearsal I attended at the Salle Wagram in Paris in 1962, the conductor, who had better remain unidentified, spent what the orchestra considered was too long on a familiar French composition and the orchestra signified its disapproval by going on playing but wearing their hats.

I feel that something similar might have happened during this recording . . . for the Fantastique is a work every French orchestral player of any merit should be able to play without more than an occasional glance at the score. Yet the performance here is anything but idiomatic. True, the Paris Conservatoire Orchestra is far from being one of the world's best and the conductor for this recording was a Spaniard. But this does not explain the restlessness that disfigures many of the long legato melodies and the lack of elegance in the Ball Room Scene waltz. I find it hard to put all the blame on Argenta for these lapses. He had, before his death in 1957, proved himself to be a much better conductor than is heard here.

Argenta obviously had strongly personal preferences for the way this symphony should be played. After all, no orchestra would make the unexpected accelerando towards the end of the "March to the Scaffold" without being urged to do so by the conductor. And perhaps the lack of any real pianissimos cannot be blamed wholly on the engineer. But there is something slipshod about the whole performance—and recording, note the very odd bell effect—that seems to apportion general blame.

Not that it hasn't its moments, and the engineering is, some of the time, very good indeed, with plenty of presence, if sometimes a little shrill and brittle. The French orchestra also plays parts of the score with enchanting sensitivity. But the lapses outweigh these by no means negligible virtues especially when such a version as the Beecham (1959) seems about due for reissue on a cheap label. My advice is to wait for this happy event.

* * *

BERLIOZ—Grande Symphonie Funebre et Triomphale. Chorale Musicale de Paris and La Musique des Gardiens de la Paix conducted by Desire Dondeyne. World Record Club Stereo T/4020.

I am as enthusiastic about this Berlioz recording as I am reluctant to recommend the one noticed above. Originally in the French "Erato" catalogue, the work is not easily available on any label obtainable in Commonwealth countries. The only other version I know is the old Nixa which is now about 12 years old and betrays it age, especially when played straight after the new World Record Club issue.

Nixa added a string orchestra (of Cologne) to the usual military band (Symphonic Brass Orchestra of Cologne) with the Cologne Choir under the direction of Fritz Straub. This means that they used a score revised by Berlioz some time after the original was written. The work, by the way, was commissioned by the French Government of 1840 to celebrate the anniversary of the 1830 revolution, a minor conflict compared to the big one which started in 1789. In the performance under review, the ensemble conforms much more closely to Berlioz' original ideas.

The symphony is grand, in a romantic way, without being grandiose. Richard Wagner, no Francophile, who heard it in Paris when he was 27, wrote a rave notice about it, using such phrases as "great, from the first note to the last." As the title suggests, the first movement is a funeral march of tall dignity, a stately processional interrupted by flaring climaxes that proclaim immortality. The scoring for this combination—military band—reveals the vast technical resources possessed by Berlioz, resources that have made him deservedly famous as one of the world's greatest orchestrators.

The second movement, entitled by the composer "Funeral Oration," features what might be called a recitative and aria for tenor trombone, played here with commendable skill and taste by Harry (sic) Prutot. It is a wordless ode which loses nothing of eloquence in the absence of voice or text. In the finale Berlioz added a choir to sing words in glorification of the dead, words which look banal on paper but are transformed by Berlioz' music into something altogether noble. The choir's first entrance is dramatically stupendous. Later a little more weight might have been added with profit but the overall effect is still thrilling.

On the whole I prefer Dondeyne's tempos to Straub's, especially in the last movement where the latter's hurrying gait reduces the movement's grandeur. Dondeyne gives us a tempo that explains Wagner's description of the movement as "noble and grave." The sound throughout is faithful, satisfyingly balanced, with a clarity that reveals all the genius of Berlioz' magisterial instrumentation.

* * *

LEHAR—The Merry Widow. Complete Operetta. Hilde Gueden; Per Grunden; Waldemar Kmennt; Emmy Loose; Karl Donch; Peter Klein; Kurt Equiluz; Marjan Rus; Hans Duhan; Peter Preses; Ljubomir Pantscheff; Edith Winkler. Vienna State Opera Chorus and Orchestra conducted by Robert Stolze. Ace of Diamonds Stereo SDDA113.

Comparison is inevitable between this 1958 recording now reissued at an economy price, and the famous HMV set starring Schwarzkopf, Wachter, Gedda and Steffek. Put bluntly, the latter is infinitely preferable on many counts. The singing is on the whole more stylish, especially that of the men. And in the version under review, Hilde Gueden, though pleasant enough, is far from being in Schwarzkopf's class.

The orchestra plays with true Viennese charm and the chorus is well-drilled, if a trifle backwardly recorded. All things considered, if price is a prime consideration, the Ace of Diamonds issue is well worth the money. But personally I should be happy to pay the extra for the Schwarzkopf-Wachter set.

On the credit side, however, the 1958 set has a more complete vocal text with more spoken dialogue than its rival. Although it was made in the comparatively early days of stereo the sound is good, if sometimes a little thick through the middle, and better jobs are made of tape joins nowadays.

ALWAYS RELY ON R.D.S.

HI-FI SPECIAL FOR MARCH

Using:—

R D S

1—Star SA30 Amplifier complete—12 watts per channel—Frequency response 50—50,000 cps ± 1 db at 12 watts

2—Slimline Teak Cabinets fitted with 8mx speakers

1—AT6 Garrard Changer Player fitted with 105 Ronette cartridge.

Price for complete system including sales tax £98/19/6 $197.95

Teak Base optional Extra £3/10/0 $7

Suppliers of all Radio and TV Components — Meter and Multimeters.

H200 Multimeter £5/12/6 Nett $11.25

CT500 Multimeter £6/9/4 Nett $12.93

The Independent Wholesaler

RADIO DESPATCH SERVICE,
Radio and Electrical distributors,
Cnr. George and Harris Streets,
869 GEORGE STREET, SYDNEY.
Phone 211-0816, 211-0191.

Open Saturday mornings.

HOROWITZ AT CARNEGIE HALL — Piano Recital.
Bach-Busoni—Organ Toccata in C Major.
Schumann — Fantasy in C Major, Op. 17;
Scriabin—Poem in F Sharp Minor; Etude in C Sharp Minor;
Chopin—Mazurka in C Sharp Minor; Etude in F Major; Ballade in G Minor. CBS Stereo S2BR220012.

This record set is an example of a truly American "hard sell." The notes accompanying the two-disc boxed set read like a publicity man's spiel about a film star. We are asked to believe that Horowitz's return to the concert stage after 12 years' silence almost stopped the New York traffic as effectively as the recent strike. We are told how he pondered the pros and cons of this momentous decision which he announced with all the dramatic effect of a De Gaulle. And all through the recital, items are separated by frenzied clapping and sometimes ecstatic shouts.

I found the last feature tiresome enough to destroy much of my enjoyment in some fine playing. The only way to avoid the din is to turn off the sound until it has finished. But if you can overcome your repugnance at the vulgarity of such a presentation you will find much that is rewarding. For Horowitz, after 12 years in the musical wilderness, has returned as strong as ever in the features that provoked admiration over a decade ago. His technique is still something to marvel at, his contrasts of timbres as colourful as in his heyday.

His approach to other men's music is still that of a conscienceless virtuoso bent on self-glorification rather than faithful service to the composers' intentions. The contrasted sonorities mentioned above can perhaps best be appreciated in the Bach/Busoni Organ Toccata where they supply real pleasure to the most discriminating ear, though, it must be added, at the expense of much that is acceptable as true Bach style. The Schumann Fantasy's episodic character responds more gratefully to such treatment though the recorded tone of Horowitz's piano could with profit have been made to sound rather less dry.

Perhaps the most successful performances are to be found in the two Scriabin pieces which are both most sensitively delivered. But the fact cannot be ignored that there is still a very lar public for the sort of virtuoso exhib tion that is given here. Its shortcomin are, generally speaking, lapses of tast Seldom can the player be accused technical inadequacy.

(Editor's Note: This Horowitz recit was also reviewed by our reviewer Ra say Pennecuick in the January, 196 issue.)

* * *

BRAHMS—Hungarian Dances.
DVORAK—Slavonic Dances. Vienn Philharmonic Orchestra conduct by Fritz Reiner. Ace of Diamon Stereo SDDA123.

The Brahms bracket includes t Hungarian Dances Nos. 1, 5, 6, 7, 1 13, 19 and 21 in orchestrations by fo different musicians, only the first, in Minor, being scored by Brahms hin self. The Slavonic Dances represente are Nos. 1, 3 and 8 from Opus 46, an Nos. 1 and 2 from Opus 72. The soun is fine, bright, with plenty of presenc and the playing of the Vienna Phi harmonic all that might be expected that illustrious combination. Exceller value in a disc that should appeal all tastes.

PURE
Hi-fi stereo SOUND

This quality record player is the latest from Goldring, long renowned for the best in sound reproduction. The unit features Precision Turntable, Linear Amplifier and matched separate Speaker Enclosures, guaranteeing results. Both the control unit and speaker enclosures are finished in Teak.

SPECIFICATIONS:

(1) RECORD PLAYER Goldring-Lenco G66 Semitranscription Player, 4 speed with over-riding speed variation. Built-in Micro-lift for precise track selection and pick-up placement, detachable head shell and the unit comes complete with Ceramic Cartridge CS-80 fitted with Diamond Stylus.

(2) AMPLIFIER....... Custom-built 7 Watt (RMS) per Channel distortion-free Stereo Amplifier. Separate controls for Bass and Treble Tone and Mode switch, allowing Mono/Stereo selection and Channel reversing.

(3) SPEAKERS....... Acoustically designed Speaker Enclosures, Fibre Glass Wool lined, fitted with 8" Twin Cone Ferrite Magnet Speakers.

GOLDRING 7/7 HI-FI STEREO PLAYER

GOLDRING
Sales & Service

N.S.W.:
443 Kent Street,
Sydney. 29.1528

VIC.:
368 Little Bourke St.,
Melbourne. 67.1197

W.A.:
144A William Street,
Perth. 21.6500

QLD.:
235 Edward Street,
Brisbane. 2.3247

S.A.:
77 Wright Street,
Adelaide. 51.5117

GE:P25

DOCUMENTARY RECORDS

Reviewed by Ellis Blain

A MAN AND HIS HORSE. Read by Chips Rafferty. Festival FL31015 (Mono).

This record has been slow to come to my attention; a pity, as it achieves what it sets out to achieve exceptionally well. Primarily, its appeal will be to country people, to those who love horses and to archivists, in the popular sense of the word. The approach is dead straight and Chips Rafferty succeeds in doing justice to the verses of Banjo Patterson, Will Ogilvie and Adam Lindsay Gordon while tying the whole thing together with his unique personality and completely convincing readings.

* * *

SIX STORIES FROM FARAWAY PLACES. Danny Kaye. London HAA 7703.

A cherished relief from the usual pattern of Kaye on record. These are straight stories told with all the brilliance of characterisation, all the ebullience and raffish style of which the inimitable Mr Kaye is capable. The production is enhanced by specially composed music and sound effects which are handled with restraint. The sound quality is exceptionally clean and captures that elusive combination of intimacy, presence and dramatic "space." Magnificent entertainment for young and old.

* * *

WALTER MURDOCH TALKS. Brolga BZS16.

The Recording Society of Australia, which produces Brolga records, deserves commendation to a wider audience as not only is it doing a splendid job in its specific field of "Australiana," but many of the records it is producing can hold their own as entertainment in a commercially competitive world. The society is a non-profit organisation devoted to the development of the arts in Australia. Further information can be obtained from the hon. secretary, Box 572, G.P.O., Sydney.

In the past, many Brolga recordings suffered from poor sound quality, but in the case of the disc under review, this has been overcome by arranging for the masters to be made in the A.B.C. studios and leaving the processing and manufacturing in the skilled hands of E.M.I.

Walter Murdoch is one of the great entertainers among Australian academics and, as such, he was well ahead of his time. He was born in Aberdeen 92 years ago, and in 1913 was appointed first Professor of English at the University of Western Australia. His mind is original, liberal, often provocative and invariably stimulating, while his literary style is not only eminently readable but also popular in the best sense of the word.

This recording was made when he was 86, but don't expect to be greeted by the voice of an octogenarian. Here is a man in the prime of life, completely at home in the recording studio and as relaxed as if he were talking to you in your own armchair over a decanter of good Scotch. The first subject for conversation is "Tripe And Onions," and it sets the pace as an excellent example of the man's serious irreverance for what is inflated and over-important. "Sound," "A Roman Holiday," "One Leg Island" and "Heaven" follow in that order, and the whole thing is preceded by an excellent "autobiography."

A record that will need no recommendation to Professor Murdoch's innumerable admirers and which will serve simultaneously as a first-class introduction to anyone who is a stranger.

* * *

SIOBHAN McKENNA READING IRISH POETRY . . . Argo RG 158 (Mono).

Truly a record of poetry to be treasured almost above all others. Not only is Irish poetry unique in its literary aspects but it has an appeal which is all but universal. Here we have, on Side 1, Poems of William Butler Yeats and on Side 2, Irish Ballads, Folksongs And Lyrics. Of the two I must confess to preferring the second, simply because so much of it came freshly to me and all of it is so beautiful—the very heart of poetry.

But, above all, it is the voice and the music of Siobhan McKenna's reading that will stay with you long after the last track has run out. This extraordinarily beautiful woman is an actress of remarkable quality who has the ability, rare indeed, to speak poetry in a manner which transcends technique, finding its way straight to the heart.

* * *

FAMOUS GHOST AND HORROR STORIES, read by Nelson Olmsted. Vanguard VRS 9008.

The writers range from Fitzjames O'Brien through Theosophile Gautier, Robert Louis Stevenson and Ambrose Bierce to Charles Dickens. The appeal of records such as this is undoubted and the reasons for it are convincingly set out by H.P. Lovecraft in his work entitled "Supernatural Horror in Literature" . . .;

> "The oldest and strongest emotion of mankind is fear and the oldest and strongest kind of fear is fear of the unknown. As a result, in spite of all opposition, the weird tale has survived, developed and attained remarkable heights of perfection; founded as it is on a profound and elementary principle."

Nelson Olmsted's reading is professional and the more effective for being that little bit underplayed. Recorded sound is first rate. ■

ANNOUNCEMENT

An inaccuracy occurred in the Roband advertisement which appeared on the inside front cover of last month's issue

RDV 42 MAX. SENSITIVITY

100V should read 100 μV

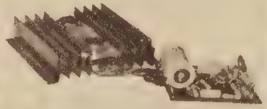
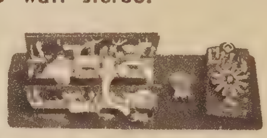
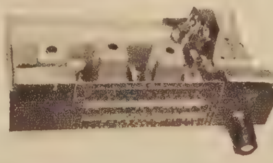
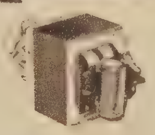
AMALGAMATED WIRELESS (Australasia) LTD.

"S.E.W." TRANSISTOR KITS

Full transistorised in mono and stereo. Also as P.A. units.

Easy to Assemble Hi-Fi Modules

Available at a price anyone can afford, prebuilt modules with performance equal to the highest price units. Easy to assemble units form a simple pre-amp to a 100 watt stereo.

Units available at present include 10 watt amplifiers.

Low distortion TRANSFORMERLESS response 30-20,000 c/s.

Tone control and PRE-AMP UNIT with low noise transistors.

Input control unit-wired for 5 inputs.

Power supply unit will supply mono or stereo.

Wide band transistorised Tuner Using silicon Transistors.

Unit 1. 10 Watt Amplifier 15 Ohms	£18	18	6	$37.85
Uit 2. 10 Watt Amplifier 3 Ohms	£18	8	6	$36.85
Unit 3. 20 Watt Pulse Amplifier				
Unit 4. Pre-Amp and Tone Control	£14	18	0	$29.80
Unit 4A. Pre Amp-Mono	£ 9	18	0	$19.80
Unit 5. 4 Channel Mixer input ..	£13	15	0	$27.50
Unit 6. 4 P.A. Mixer Output Stage	£ 5	0	0	$10.00
Unit 7. V.U. Meter with amplifier	£ 8	0	0	$16.00
Unit 8. Input Control — Stereo ..	£ 5	6	0	$10.60
Unit 9. Power Supply—24V or 40V	£ 8	13	0	$17.30
Unit 10. Wide Band Transistorised Tuner	£17	17	6	$35.75
Unit 11. Special 100 Watt Amplifier	£32	0	0	$64.00

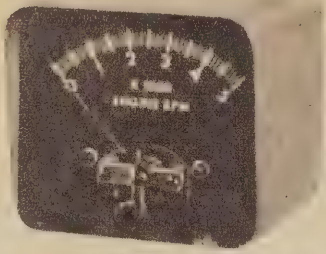
Special Equipment Designed Or Built To Your Specifications.

Available from Distributor or direct from:

S. E. WILLIS TRADING CO.

38 RIVERSDALE ROAD, CAMBERWELL, VIC. 82-5787

ELECTRONIC DEVELOPMENTS PTY. LTD.



6V & 12V TACHOMETER
$19.25

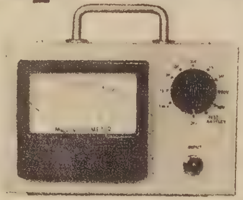
BM3 CRYSTAL MIC. (Stand extra)
$5.00

TOP QUALITY M/METER
$9.25

WE STOCK METALWORK AND PANELS FOR ELECTRONICS AUSTRALIA PROJECTS AND NUMEROUS OTHER TYPES

ALUM. & STEEL CHASSIS
ALUM. PANELS
AMPLIFIERS
PREAMPS
SPEAKERS
MICROPHONES
TAPE DECKS
RECORDING TAPE
VALVES
TRANSISTORS
PICTURE TUBES
TRANSFORMERS
CHOKES
TV AERIALS
TV COMPONENTS
CONDENSERS
RESISTORS
RECORD PLAYERS
RECORD CHANGERS
TRANSCRIPTION UNITS
METERS
TEST EQUIPMENT
PICKUPS
CARTRIDGES
STYLI
VIBRATORS
PRINTED CIRCUITS
COILS

Popular Kits — Top Quality — Low Price

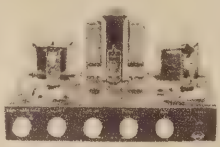


Transistor m/v Meter

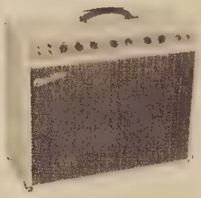
PLAYMASTER PROGRAM SOURCE

Playmaster III

Impedance Meter



Mullard Stereo 3-3



103 Guitar Amp.

Playmaster 110 Tape Amp.

"GOLDEN SERIES" 20 WATT GUITAR AMPLIFIER (with Vibrato)

MULLARD 3-3 STEREO AMPLIFIER

MULLARD 10-10 STEREO AMPLIFIER

50 & 144 MC CONVERTER KITS

PLAYMASTER 108 STEREOGRAM

PHILIPS MINIWATT TWIN 10 HIGH QUALITY STEREO AMP.

PLAYMASTER 103
GUITAR AMPLIFIER WITH REVERB AND VIBRATO
Write for particulars

HI-F1 3 MONAURAL AMPLIFIER

ELECTRONIC DEVELOPMENTS PTY. LTD.

Phones 63-3596
63-5973

232 FLINDERS LANE
MELBOURNE . . . . VICTORIA

Phones 63-3596
63-5973

ELECTRONIC DEVELOPMENTS PTY. LTD.

KITSETS - - BUILD IT YOURSELF SAVE £££s

AMPLIFIERS
GUITAR
1 Golden Series, 12 Watt.
2 Std. Series, 20 Watt.
3 Std. Series, 10 Watt.
4 Std. Series, 25 Watt.
5 Std. Series, 35 Watt.
6 Std. Series, 50 Watt.
7 Playmaster 102.
8 Playmaster 103.
HI-FI MONAURAL
9 H-Fi 3
10 Mullard 3-3
11 Mullard 5-10
12 Mullard 5-20
HI-FI STEREO
13 Basic 2
14 Mullard 2-2
15 Mullard 3-3
16 Mullard 10-10
17 Philips Twin 10
18 Playmaster Twin 10
19 Playmaster Twin 17
20 Playmaster Unit 1
21 Playmaster Unit 2
22 Playmaster Unit 3
23 Playmaster Unit 4
24 Playmaster 101
25 Playmaster 105
26 Transistor 1W
27 Transistor 2W
28 Transistor 5W
29 Transistor 10W
P/A UNITS
30 Standard 10W
31 Standard 25W
32 Standard 35W
33 Standard 50W
34 Standard 100W
35 Transistor 10W
36 Transistor 30W
TAPE UNITS
37 Mono No. 3
38 Mono No. 4
39 Stereo
40 Steereo Adapter.
41 Stereo Phone Amp.
PREAMPLIFIERS
42 Transistor Mono
43 Transistor Stereo
CONTROL UNITS
44 Playmaster No. 8
45 Playmaster No. 9
46 Playmaster No. 10
47 Playmaster No. 104
48 4-Channel Mixer
49 Philips Magnetic 3V
50 Mullard 2V
51 Mullard 3V
52 Transistor Mono
53 Transistor Stereo
CONVERTERS
54 S/W Batt. 1
55 S/W Batt. 2
56 S/W A.C. 1
57 S/W A.C. 2
58 All Wave A.C. 2
59 Transistor
60 50 MC/S
61 144 MC/S
62 50-144 MC/S X'Tal Locked
63 D.C.-D.C. 40W
64 D.C.-D.C. 60W
65 D.C.-A.C. 40W
INSTRUMENTS
66 3in C.R.O.
67 5in Wide Range C.R.O.
68 Wide Band C.R.O. Preamplifier
69 R/C Bridge
70 V.T.V.M. (1966)
71 Electronic Stethoscope
72 Sweep Generator
73 Sweep Marker Generator
74 Pattern Generator
75 Diode Noise Generator
76 G.D.O. Adapter
77 Standard Audio Oscillator
78 1962 Wide Range Audio Oscillator
79 Transistor Wave Meter
80 Transistor Signal Tracer
81 Transistor Pattern Generator
82 Transistor Audio, OSC.
83 Valve and Transistor Tester
84 Millivoltmeter
85 Distortion, Noise and Millivoltmeter
86 Mullard Tachometer
87 "R" Decade Box
88 "C" Decade Box
89 Electronic C.R.C. Switch
90 Geiger Counter
RECEIVERS
91 DXERS (Batt.) 1
92 DXERS (Batt.) 2
93 DXERS A.C. 2
94 DXERS A.C. 3
95 DXERS 3 Band 3
96 Little General 1961
97 Interstate 5
98 1962 Stereogram
99 Fremodyne 4
100 Amateur RX
101 Transistor 1
102 Transistor 2
103 Transistor 3
104 Transistor 4
105 Transistor 5
106 Transistor (R.F.) 7
107 Transistor 8
108 Transistor 3 Band 8
TRANSMITTERS
109 V.F.O. 1962
110 Remote V.F.O. 1963
111 144 MC/S A.M. TX
112 144 MC/S S.S.B. TX
113 1962 S.S.B. TX
114 144 MC/S Linear Final
MISCELLANEOUS
115 Light Beam Relay
116 Flasher Unit
117 Regulated 9V D.C. Supply
118 Universal Battery Charger
119 Intercomm. Unit
120 Metronome Unit
121 TV Hearing Aid
122 Porta Player

If you cannot see your project listed—write for a quote, we have many other units available or in development.

METERS —— METERS —— METERS

All types . . . all sizes . . . all ratings . . . BUT with a single common factor — TOP QUALITY AND LOW COST
CHECK THE VALUE FOR BARGAIN BUYING — (all meters meet BSI standard)

Meter Size	Movement	*Price
1⅞" x 1⅞"	50 Microampere	$5.25
" "	100 Microampere	$4.45
" "	500 Microampere	$3.40
" "	50-0-50 Microampere	$4.25
" "	100-0-100 Milliampere	$3.95
" "	0-1 Milliampere to	$3.25
" "	V.U. Meter	$5.25
" "	"S" Meter	$4.75
3½" 3"	50 Microampere	$8.60
" "	100 Microampere	$7.00
" "	500 Microampere	$5.50
" "	50-0-50 Microampere	$7.00
" "	100-0-100 Microampere	$6.20
" "	0-1 Milliampere to 0-500	$4.75
3½" x 3"	V.U. Meter	$8.25

Meter Size	Movement	*Price
4½" x 4½"	50 Microamperer	$9.60
" "	100 Microampere	$7.85
" "	500 Microampere	$6.20
" "	50-0-50 Microampere	$7.85
" "	100-0-100 Microampere	$7.00
" "	0-1 Milliampere	$5.75
" "	V.U. Meter	$9.85
	Horizontal Reading Meters	
Scale 3½" x 1"		
	0-50 Microampere	$9.85
	0-100 Microampere	$8.95
	0-500 Microampere	$8.30
	0-1 Milliampere to 0-500 Milliampere	$7.50
	Stereo Balance	$7.75

***PLUS 12% S/TAX**

Many other types including ammeters, voltmeters, battery and tune meters, round, square, rectangular and horizontal readings. Write for further particulars.

Loudspeakers
High Fidelity

FANE

Reproducers
High Wattage

UNSURPASSED FOR POWER HANDLING — FROM 20 TO 60 WATTS — R.M.S. LEAD—RHYTHM AND BASS GUITAR TYPES
Also Electronic Organ Units High Fidelity Types—Freq. Response 30CPS-15Kcs — Write for Specifications and Prices.

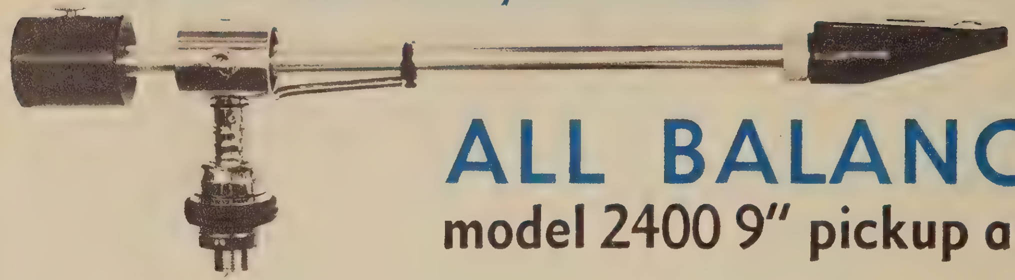
ELECTRONIC DEVELOPMENTS PTY. LTD.

Phones 63-3596
63-5973

232 FLINDERS LANE
MELBOURNE . . . . VICTORIA

Phones 63-3596
63-5973

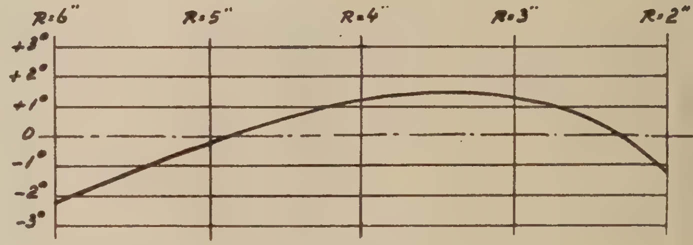
the best choice for your turntable:



ALL BALANCE

model 2400 9" pickup arm

This **ALL BALANCE** pickup arm will be an excellent choice for any high quality turntable on the market today. It's many features make it an ideal carrier (and a very careful one!) of your high compliance cartridge. Thanks to its very low friction in all bearings the **ALL BALANCE** arm will track perfectly at less than 1 gram!



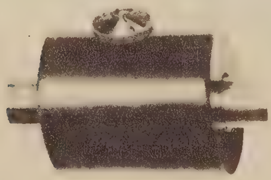
R = RECORD RADIUS

This picture clearly shows the favourable tracking erro course; a tracking error that hardly, and only in the ver first grooves of the record, surpasses the 2 degrees, de creasing to zero two times during playing.

With this new headshell cartridge mounting becomes extremely easy. It is done in a few seconds, on a small aluminium plate supplied with the arm; after that plate and cartridge can be set in their correct position with only one screw.

No soldering is required and the four shielded wires can be connected with any crystal, ceramic or magnetic, stereo or mono cartridge. In order to reach the lowest possible tracking error, the shell was designed in such a way that a very exact overhanging-adjustment can be made.

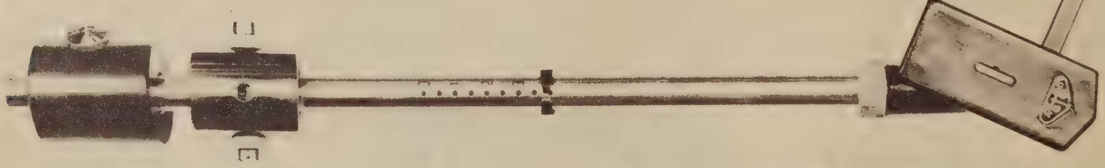
With the balance weight mounted on the tube of the arn cartridges weighing from 4-22 grams can be balanced ver accurately, giving the arm a wide range of possibilities.
It means that not only the heavier cartridges, some o which use a built-in transformer, but also the latest ultra light ones can be used successfully.



After having balanced the arm, the tracking force can be adjusted very exactly, without disturbing the static balance, between 0 and 4 grams.

Technical specifications

nominal length	236 mm (9¼'')
overall length	310 mm (12¼''
distance pivot arm/turnable centre	220 mm (8⅝'')
resonance	outside 20-20,000 cycle
sideward load (measured on stylus tip)	15-20 mg
tracking force adjustment	0-4 gram
minimum tracking force	¾ gram
overhang stylus	16 mm (⅝'')
bearings	readjustable ball bearings in every turning point



a product of ACOUSTICAL — HOLLAND

Sole Australian Agent

G. R. D. INSTRUMENTS PTY. LTD.

6 RAILWAY WALK, CAMBERWELL, VIC.
TELEPHONE 82-1256

VARIETY FARE

"ELECTRONICS Australia"
Staff Review
Panel

Devotional

THE LONDON SYMPHONIC BAND AND MALE CHORUS. Conducted by Paul Mickelson. Stereo, Supreme SS-2004. Also available in mono SM-1004. (Available from Southwell Supplies, 176 Geelong Road, Footscray, W.11, Vic.)

Interest: Sacred symphonic.
Performance: Of a high order.
Quality: Excellent.
Stereo: Normal spread.

Paul Mickelson demonstrates further his ability and musicianship by arranging and conducting this quite ambitious program of devotional music.

The London Symphonic Band is of true symphonic proportions and many will reckon the album worth its price just for the performance on side 2 of Bach's Toccata and Fugue in D-Minor. As an organ solo this is familiar to the point of being hackneyed, but the performance here has a breadth and definition which is completely refreshing.

However, this is not by any means the only item on the album and the London Symphonic Band and Chorus present a variety of traditional hymns—or should I say hymn arrangements?—which again are a refreshing change from the usual presentation concepts: Holy, Holy, Holy (Heber, Dykes, Leitzen) — There's A Wideness In God's Mercy (Faber, Tourjee, Mickelson) — Lead Kindly Light (Dykes, Leitzen) — God The Omnipotent (Chorley, Ellerton, Lvov, Mickelson — O Lord Most Holy (Ryder, Cesar Franck, Barr) — Glorious Things Of Thee Are Spoken (Newton, Haydn, Mickelson) — Doxology (Bourgeois, Leitzen)—O God Our Help In Ages Past (Watts, Croft, Koehler).

If you like devotional music with more than the usual substance—recommended. (W.N.W.)

★ ★ ★

A STILL SMALL VOICE. The Living Bible—7. Sir Laurence Olivier reads from the Old Testament. With music from the Holy Land researched by Cyril Ornadel. Presented by Douglas Fairbanks jun. Mono, World Record Club LB-7.

Interest: Bible reading.
Performance: Excellent.
Quality: Excellent.

In the September issue, last, we reviewed the first of this living Bible series, originally recorded for H.M.V. and being released in Australia through the World Record Club. We were enthusiastic then about the quality of the first album; and this one, the seventh out of the complete series of 12, earns exactly the same approval.

The reading by Sir Laurence Olivier is human and compelling and, once having started to listen, it is literally difficult to break off. Lovers of the scriptures will find new inspiration from these familiar passages, while the reading should also be of considerable value to others whose interest is primarily in the reading itself.

This particular disc covers: The Death of Jonathan — David and Bathsheba—Absalom—Solomon—Elijah. For those who may wish to follow the reading, the scripture text is set out on the jacket, the brief musical interludes serving, as much as anything, to bridge the gaps so that the excerpts are welded into a complete narrative.

In its double-fold jacket, richly illustrated with reproductions of famous works of art, this is indeed a quality production. If you can't afford all 12 of the albums, it will be a matter of picking those which appeal most. (W.N.W.)

★ ★ ★

SONGS OF THE NAZARENE. Ronnie Avalone, vocal, with the London Concert Orchestra and Choir, arranged and conducted by Paul Mickelson. Stereo, Supreme SS-2027. Also available in mono SM-1027. (From Southwell Supplies, 176 Geelong Road, Footscray, W.11, Vic.)

Interest: Gospel songs, operatic style.
Performance: A matter of opinion.
Quality: Excellent.
Stereo: Normal spread.

I remember reviewing a disc by Ronnie Avalone, some years ago, on another label, but this is his first release for "Supreme."

Trained from his early teens as an operatic tenor, he moved from smaller roles, through Broadway appearances to the Metropolitan opera. Then, dissatisfied with life before the footlights, he decided to devote his talents to Gospel singing.

He is teamed here with the London Concert Orchestra and Choir under Paul Mickelson, who provide backing of a kind that will bear comparison with anything you are likely to hear from the big-name orchestras and chorales.

But I fear that Ronnie Avalone's singing will be enjoyed only by those who have a special liking for the operatic style, at least of the particular kind. On stage it may be spectacular but I find myself inevitably squirming in anticipation of the phrases which are variously forced or sobbed and the climactic notes which so often float off pitch—or seem to, to my simple ear.

This puzzles me somewhat for, let's face it, he is a very popular Gospel singer and Supreme went to a great deal of trouble to bring this record into being. Perhaps it's one you should hear for yourself, in case I do him an injustice.

The titles: When God Speaks — The Unveiled Christ — It's Real — My Wonderful Lord — Ship Ahoy — Wonderful Peace — Look And Live — The Love Of God — Ten Thousand Angels — He'll Understand And Say Well Done — Jubilate. (W.N.W.)

ROYAL TELEPHONE AND OTHER SONGS OF FAITH. Jimmy Little, vocal with orchestra. Mono, Festival, FL-31,797.

Interest: Gospel songs.
Performance: Jimmy at his best.
Quality: Good.

Jimmy Little's "Royal Telephone" on a 45 EP disc has topped the 75,000 mark and is still selling well. The number is repeated here, followed by another in similar style—the traditional "He's Got The Whole World In His Hands."

Also included is "His Faith In Me" and "Silent Night," most of the other tracks being traditional hymns of the Church: "Blessed Assurance," "Who Is On The Lord's Side," "Crown Him with Many Crowns," "Praise My Soul The King Of Heaven," "Stand Up For Jesus" and "Hold The Fort."

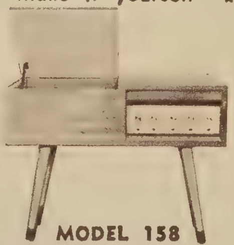
Jimmy rounds off the album with "Way Of The Cross," another one from a 7-inch EP, and "Story Of The Way Of The Cross," in which he relates the crucifixion story in his own words.

The record jacket contains no identification of the orchestra and chorus used, nor of the organ-piano duo backing the other numbers, but the arrangements and balance are excellent—with a general up-tempo sound that is never lacking in good taste. And while Jimmy's voice is a little lighter than some might like, he rides the accompaniment in quite expert fashion.

In fact, if your record collection does not contain an album of this gifted young "original Australian," whose smiling face is featured on the cover, this one is well worth considering. (W.N.W.)

STEREO EQUIPMENT CABINETS

New 1965 models are now available. Can be supplied in "make it yourself" kits.



MODEL 158

Designed to accommodate all popular amplifiers and players. Size: 34in wide, 9in high (front opening 6in high), 16in deep, 15in removable legs.

Price for Maple Veneer:

Made and polished	£17	10	0
Packing		6	0
Kit of parts	£11	0	0
Packing		4	0
Teak veneer, extra ....,	£2	2	0

Free on rail.

Write for Catalogue

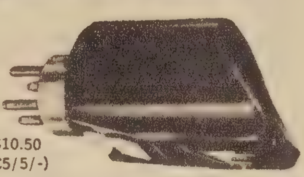
H. B. RADIO PRODUCTS

Manufacturers of Quality Radio and Radio Furniture for 36 years

103-105 Catherine Street,
LEICHHARDT, SYDNEY.
Telephone: 56-5580

DECCA

Latest Range Including Recent New Additions



$10.50
(£5/5/-)

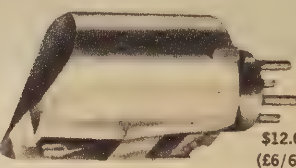
Deram Stereo/Mono Autochange Cartridge

Diamond stylus: .0005/6"
Tracking weight: 3-5 gm
Output: 80 mV/cm/sec
Load impedance: 2 meg
Compliance: 6 × 10⁻⁶

$46.60
(£23/6/-)

NEW ffss Mark III Stereo Pick-Up Head

ELIPTICAL diamond stylus: .0003" × .0008"
Compliance: 15 × 10⁻⁶ lat., 4 × 10⁻⁶ vert
Tip mass: less than 1 milligram
Frequency response: ± 1 dB 20-16,000 cps

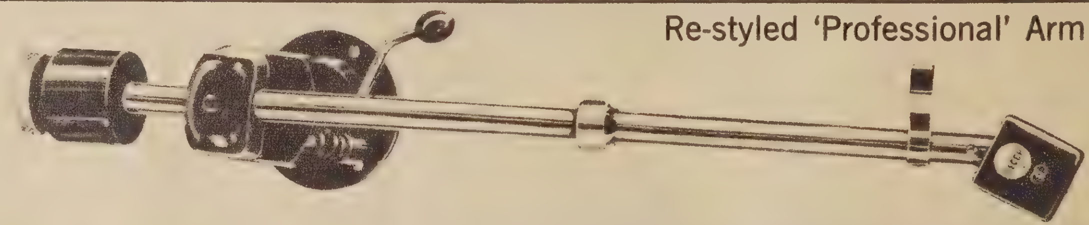


$12.60
(£6/6/-)

Deram Stereo/Mono Transcription Head

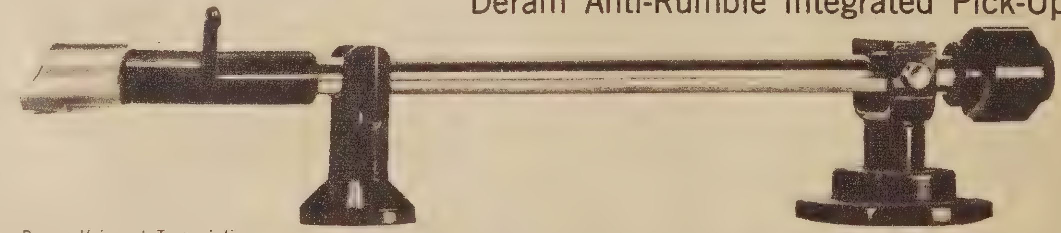
Diamond stylus: .0005/6"
Tracking weight: 2½ gm
Output: 50 mV/cm/sec
Load impedance: 2 meg
NEW COMPLIANCE: 9 × 10⁻⁶
Tip mass: .6 milligram

Re-styled 'Professional' Arm



A superb precision pick-up arm with many advanced features. Coarse and fine counterweight adjustments for perfect dynamic balance; sliding counterweight and accurately calibrated scale to cater for the stylus pressures of the complete ffss range of heads; built-in lowering device; bias compensation. The pick-up leads are brought out to a 4-pin socket for ease of installation. Complete with Mark III head, $100.60 (£50/6/-).

Deram Anti-Rumble Integrated Pick-Up



Deram Universal Transcription Arm, to accept all ½" cartridges, also available. Price, complete with head shell, ***$17.95 (£8/19/6).***

In the Decca Deram ARI pick-up, the mechanical combination of arm and head has been arranged to effect directionally selective filtering which almost eliminates the most troublesome rumble frequencies without reducing any required low frequency signal. The arm will accommodate all Deram pick-up heads. Price complete, $30.55 (£15/5/6).

Decca Microlift

Fit a Microlift and avoid damage to stylus and records. Gently and accurately the Microlift lowers the stylus onto the record at any point you choose . . . and also lifts it clear. $4.35 (£2/3/6).

Decca Stylus Cleaner

Suitable for use with any pick-up; helps to keep records and stylus in excellent condition. Price, $3.95 (£1/19/6).

Write or send coupon for free descriptive technical literature

Sole Australian Agent:

BRITISH MERCHANDISING
PTY. LTD.
60 Clarence St., Sydney. Telephone 29.1571

Name..
Address...
....State..............
DECCA

WEET HOUR OF PRAYER. Jesse Crawford, The Poet of the Organ. Mono, Festival DL-31,770.
Interest: Organ, hymn tunes.
Performance: Routine.
Quality: Normal.

After a period, in the early thirties, as one of the big-name cinema organists, Jesse Crawford sank into relative obscurity, along with the massive instruments which he played. More recently, with a resurgence of interest in the popular organ, the name of Jesse Crawford (more correctly, the late Jesse Crawford) has reappeared on discs which vary a good deal in their appeal — as judged by popular organ standards.

This one, of simple Gospel hymns, leaves little scope for virtuosity and the end result sounds little different from what might be offered by any other proficient organist playing hymn tunes on an electronic instrument. In fact, I'd have liked it much better if Jesse Crawford had better exploited the basic voices of the instrument and cut down on the chimes which freely punctuate every number. They are more likely, I fear, to disrupt rather than promote the "Sweet Hour Of Prayer." The titles:

Lead Kindly Light—Jesus Is Calling—Abide With Me—O Day Of Rest—And Gladness — The Old Rugged Cross—I Need Thee Every Hour—Pass Me Not—Let The Lower Lights Be Burning — Saviour Thy Dying Love—In The Hour Of Trial—Bringing In The Sheaves—What A Friend We Have In Jesus—Sweet Hour Of Prayer—Softly And Tenderly. (W.N.W.)

Instrumental, Vocal & Humour

THE GREAT RACE—Music from the film score composed and conducted by Henry Mancini. RCA 12-inch stereo, LSP-3402. (Also available in mono, on LPM-3402.)
Interest: Film music.
Performance: Unremarkable.
Recording: Very good.
Stereo Quality: Exaggerated separation.

Henry Mancini's music for the score of the recent Blake Edwards blockbuster "The Great Race" is for those who would like to remind themselves of the ilm. I must confess that to me it seems rather unremarkable music, a good deal ess impressive than Mancini's previous works and, on the whole, rather boring. The Mancini talent might indeed be nexhaustible, but it sounds as if it's a rifle tired . . .

The tracks are labelled: Overture — Push The Button, Max! — The Royal Waltz — Night, Night Sweet Prince — They're Off! — The Sweetheart Tree — The Great Race March — He Shouldn't-A, Hadn't-A, Oughn't-A Swang On Me! — Music To Become King By — Cold Finger, and Pie-In-Face-Polka.

The recording quality is very good, although perhaps not up to the highest Dynagroove standards. The stereo separation is somewhat exaggerated.

Mainly for the undiscerning, I'm afraid. (J.R.)

* * *

AUSTRALIAN PIPE BAND CHAMPIONS. The Sydney Thistle Highland Pipe Band. Festival, Mono FL-31,837.
Interest: Champion bagpipers show how.
Performance: Excellent.
Quality: Good.

Many people, perhaps the majority of people, are completely bewildered by the sound of the bagpipes. Others, among whom I number myself, find their blood stirred by the sound of the pipes and can quite happily listen to the skirling tunes for hours.

If you are one of this happy group, the high class playing of the Australian Champions on this disc will delight you. The disc was made to commemorate the winning of the Australian Grade One Pipe Band Championship by the Sydney Thistle Highland Pipe Band in Melbourne last year. The band shows the form which led to its success by playing with absolute precision a selection of marches, airs, laments, fanfares and what have you from the Scottish traditional music.

There is also a fine performance of a lament in the piobaireachd style (the "classical" music of the bagpipe) by Pipe Sergeant Malcolm McRae. The Pipe Sergeant won the Gold Medal at Melbourne for solo piping with a performance of this piece. (H.A.T.)

* * *

MELODY OF LOVE. The Living Strings Orchestra, arranged and conducted by Johnny Douglas, with narration by Robert Henderson. Stereo, RCA Camden CAS-830. (Also available in mono.)
Interest: Romance—plus!
Performance: Lush strings.
Quality: Good.
Stereo: Well spread.

This is strictly for those in romantic mood, the starry-eyed, soft-lighted, rippling-water, no-one-else-exists kind of thing. On their own, the Living Strings produce their usual lush, romantic sound but, as if that's not enough, Johnny Douglas has Robert Henderson up front in three of the numbers reciting love lyrics. Depending on your mood, they may sound luvverly — or make you laugh!

Melody Of Love — That Love Of Mine — None But The Lonely Heart — A Kiss In The Dark — I Love You — Symphony Of Love — True Love — Love Theme From A Farewell To Arms —There Is No Greater Love — When I Lost You.

It's up to you. (W.N.W.)

* * *

THE HAPPY WANDERER. Lawrence Welk, orchestra and boys' choir. Dot 12-inch mono, ZL-31,790.
Interest: Happy dance music.
Performance: Happy.
Recording: Good.

A disc of "good-time" party and dance music, presented by well-known Dakotan Lawrence Welk. In their familiar "champagne music" style, Welk and his orchestra and choir jog their way through the following dozen tunes: Schatzie — Jenny Dear — Down, Down, Down, Down — The Bells in the Valley — Linda Lee — There's No One Like You — The Happy Wanderer — My North Dakota Home — My Little Sister — One of these Fine Days — The Polka Lesson, and When the Circus comes to Town.

The recording is fine, making the disc a good choice for those seeking some happy music of this type. (J.R.)

"INNERBOND" (Regd.)

BONDED ACETATE FIBRES

For packing in

SPEAKER ENCLOSURES

A new resilient Bonded Wadding made from ultra fine Cellulose Acetate Fibres that gives high efficiency for Sound Absorption.

"INNERBOND" is light, clean dust free and easy to handle. Because all the fibres are bonded "INNERBOND" will hang as a "curtain" and will not fracture or break down due to vibration.

"INNERBOND" is odourless, highly resistant to attack by bacteria or fungus and is vermin repellent: "INNERBOND" at 16oz sq. yd. has a nominal thickness of 1" and at this density is recommended as a packing in Speaker Enclosures for Sound Absorption.

STOCKISTS

SYDNEY—Arrow Electronics Pty. Ltd., 432 Kent St.; Broadway Electronics Pty. Ltd., Broadway and City Rd.
MELBOURNE—J. H. Magrath and Co. Pty. Ltd., 208 Little Lonsdale St.
BRISBANE—A. E. Harrold Pty. Ltd., 123 Charlotte St.
ADELAIDE—Duncan Agencies, 57 Woodville Rd., Woodville; General Accessories, 81 Flinders St.
PERTH—General Accessories, 46 Milligan St.

If unobtainable

For 1 sq. yd. as above send £1 0 0
For 2 sq. yds. as above send £1 17 6
For 4 sq. yds. as above send £3 5 0

Postage paid in Australia and Territories.

to the manufacturers

WONDER WOOL
PTY. LIMITED.
87 James Street, Leichhardt, N.S.W.
BOX 548 — G.P.O., SYDNEY.
Phone: 56-2780.

"TEKNI -CALS"

Technical Transfers

FOR PROFESSIONALLY MARKING AND TITLING INDUSTRIAL, SCIENTIFIC AND AMATEUR EQUIPMENT

By using Tekni-Cals it is easy to produce factory-finish markings and titles on your prototype and home-built equipment at low cost, without the aid of special devices.

Tekni-Cals are supplied in book form, each book covering a particular subject: Audio, Hi Fidelity, Transmitters, Receivers, Instruments, Oscilloscopes, V.T.V.M. and Decade Boxes, Workshop and Dial Sets.

Write TODAY for a Free Catalogue.

"TEKNI-CALS"

CUT AND MAIL

Electronic Supplies,
Box 417, P.O., Crown St., Sydney, N.S.W.

NAME . . . .

ADDRESS . . . .

. . . . E.A.3.66

AMATEUR EQUIPMENT

CHOOSE FROM THE EICO RANGE

Manufactured in the U.S.A. by EICO. Awarded 1964 Export Award.

EICO 753	*Triband SSB/AM/CW Transceiver 80.40.20 metres. VFO and IF circuit boards, preassembled crystal lattice filter. Receiver offset tuning without altering transmit frequency. Automatic carrier level adjustment.*
EICO 720	*90 watt CW Transmitter 80.40.20.15.10 metres. Completely sealed cabinet careful bypassing and choking for effective TVI suppression. One knob bandswitching.*
EICO 723	*60 watt CW Transmitter. Small brother of 720 similar specification.*
EICO 722	*Self-powered VFO. Clapp temperature compensated circuit. Low heat silicon diode power supply. 80 through 10 metres in six ranges. Output high enough to drive any modern Transmitter on all bands. Remarkable stability.*
EICO 710	*Popular Grid-dip meter. 400 Kcs-250 Mcs in 8 overlapping ranges. Meter movement 500 micro amps. Absorption wavemeter and/or phone jack zero-beating facility.*

All units with the EICO professional styling

KIT PRICES TAX PAID: **753 .... $309.12 720 .... $160.62 723 .... $106.92**
722 .... $74.30 710 .... $55.28

Sole Australian Distributor	**A. J. FERGUSON (ADELAIDE) PTY. LTD.** **189 Flinders St. Adelaide 23-1922**
Sub Distributor (Victoria).	**UNITED TRADE SALES** **280 Lonsdale St. Melbourne 32-3815**
Sub Distributor (Tasmania).	**ELECTRONIC SUPPLIES PTY. LTD.** **22 Karoola Rd. Lindisfarne 2-9192**

Instrumentation by University

Panel Mounting Meters.
Switchboard Meters.
Portable & Bench Meters.
Wattmeters, Varmeters.
Frequency Meters.
Power Factor Meters.
Synchroscopes.
Electrical thermometers.
Pyrometers.
Insulation testers.
Multimeters.
Reverse current relays.
Sensitive relays min 10 microamps.
Education and teaching equipment.
Mining test instruments.
Thermostats.
Switchboard pattern clocks.
Contact making meters.
Control units for Automation.
Special equipment to order.

UNIVERSITY GRAHAM
INSTRUMENTS
PTY. LTD.

Engineers and Manufacturers, we invite you to consult our design and advisory division by ringing 53 0644.

106 BELMORE ROAD, RIVERWOOD, N.S.W.
Telephones: 53-0644 (5 lines)
Telegraphic Address: "Raquip," Sydney

REPRESENTATIVES:

W.A.: Atkins (W.A.) Ltd.,
894 Hay Street, Perth, W.A.
S.A.: George Procter,
52 Gawler Place, Adelaide, S.A.
VIC.: Eastern Instruments Service
Pty. Ltd., 38 Milton Pde.,
Malvern, S.E.4, Melbourne.

QLD.: Keith Percy & Co. Pty. Ltd.
Box 1478V, G.P.O., Brisbane, Qld.

TAS.: W. P. Martin and Company,
188 Collins Street, Hobart:
and 134 Cambridge Street,
Launceston.

AUSTRALIA'S LEADING MANUFACTURER OF ELECTRICAL INSTRUMENTS (A UNIT OF INSTROL)

EA6

HE GOLDEN MILLIONS. Lawrence Welk and Orchestra. Stereo, Dot (Festival) SZL-931,554. (Also available in mono ZL-31,554.)

Interest: Big band sound.
Performance: Lush.
Quality: Somewhat "edgy" towards centre.
Stereo: Normal spread.

Inspiration for this album, according Lawrence Welk's own jacket notes, as a collection of songs, made famous y girl singers, which had each sold round the "golden million" pressings. hey were duly arranged for big-band resentation and here they are:

You Belong To Me — Cry Me A iver —Little Things Mean A Lot — ley There — I Can Dream, Can't I? -Why Don't You Believe Me — Let le Go Lover — Suddenly There's A 'alley — Sixteen Reasons — A Tree In he Meadow — Till I Waltz Again With ou — I Went To Your Wedding.

What else can one say, except to note at it's typical big-band — or should I y big orchestra—sound, well arranged nd well played but otherwise not pecially notable.

The recording quality on the outer acks is good but deteriorates to a oticeable "edginess" nearer the centre. till, the track titles may tempt you. V.N.W.)

* * *

RAVELLIN' MANDOLIN. Dave Apollon and the Journeymen. Festival, Mono CL-31,774, Stereo SCL-931,774.

Interest: Virtuoso mandolin performance.
Performance: Breathtaking.
Quality: Excellent.
Stereo: Effective spread.

"Brilliant" is the only word I can find describe the performance of Dave pollon on this disc. The sleeve note laims he is acknowledged as "the orld's greatest mandolin player" and, fter hearing him perform, I, for one, ould not like to dispute the claim. He eveals himself as an accomplished musiian and virtuoso and the pieces he has hosen for this disc are an admirable ehicle to demonstrate his virtuosity. he selection is a mixture of light clascal numbers and slightly hotted-up verons of well-known melodies. Although e renderings are very much in the nodern idiom, the arrangements are ever vulgar.

Technically the disc is in the "first lass" bracket, and the stereo spread is xcellent. A fascinating and enjoyable isc which you will want to play for your iends.

The titles: Moscow Nights — Just ay I Love Her (Dicentiello Vuie) — aganini Stomp — Valse Triste — ondonderry Air — Streets of Athens — Ialaguena — Scheherazade — Schon osmarin — Meadowland — Zigeunereisen — An Evening in Budapest. I.A.T.)

* * *

VINIFRED ATWELL AT THE SILVER SPADE. Winifred Atwell with orchestra directed by Terry Wilkinson. Recorded live at the Chevron Hotel, Sydney. RCA Stereo SL101670.

Interest: Popular pianiste in live performance.
Performance: Bright.
Quality: Not the best.
Stereo: Exaggerated.

Admirers of Winifred Atwell (there ust be quite a few, as some of her recordings have sold over a million copies each) have a chance here to listen to their idol recorded "live" in Australia. The occasion was Miss Atwell's final performance during her season at the Silver Spade Restaurant of the Chevron Hotel, Sydney. The recording has all the trappings of a live performance, including spasmodic applause and the "oohs" and "ahs" of the appreciative audience, as well as occasional half-hearted attempts at "singing along" on the part of the audience (mercifully brief).

Obviously intent on catering for all tastes, Miss Atwell spreads her net wide, so that her program ranges from classical to blues, taking in on the way ballads, folk tunes, past and present popular songs and film themes, all of which she performs in her breezy style. The second side features an extremely old "honky tonk" piano, said to have been bought for £2/10 in a London junk shop. Why any listener should prefer this to the grand piano used on the first side of the disc is a mystery to me.

The sound is inclined to be "woolly," no doubt because of the makeshift conditions imposed on the recording engineers. The instrument placing also leaves something to be desired in the stereo version.

The disc contains the following numbers:

Hello Dolly — Can't Buy Me Love — She Loves Me — All My Loving — Sabre Dance — Five Foot Two, Eyes of Blue — Exodus — Scottish Reels — Cuando Calienta el Sol — Basin Street Blues — Tzena, Tzena — Twelfth Street Rag — Sweet Georgia Brown — Chicago — Don't Bring Lulu — Who's Sorry Now — Black and White Rag — Poor People of Paris — Knees Up Mother Brown — Daisy Bell — I'm Forever Blowing Bubbles — After the Ball — Peggy O'Neill — Let Me Call You Sweetheart — When Irish Eyes are Smiling — My Old Man's a Dustman —

One of the best
TRANSCRIPTION UNITS
in the world...

4-Pole constant velocity (15 watt) Motor. Speed variation continues from 15 to 80 R.P.M. with Click stop at 16—33⅓—45—78 R.P.M. Wow & Flutter Maximum 0.2%; Rumble and Hum negligible. Turntable 12" x 8 lb. Unit: 15⅜" Long; 13¼" Wide; 5½" High.

GOLDRING LENCO
GL-70

The new Goldring Lenco GL70 Transcription unit is unique. It features an 8 lb. non-magnetic diecast turntable dynamically balanced with lapped steel centre spindle running in sintered bronze bush bearings. The on-off switch automatically disengages the idler wheel from the turntable underside, preventing "flats" developing and also operates a microlift mechanism for the pick-up arm, allowing precise selection of record track and manual lowering of pick-up head. The positive vertical drive system allows for continuously variable turntable speeds. Adjustable pick-up arm with detachable head shell.

GOLDRING SALES & SERVICE

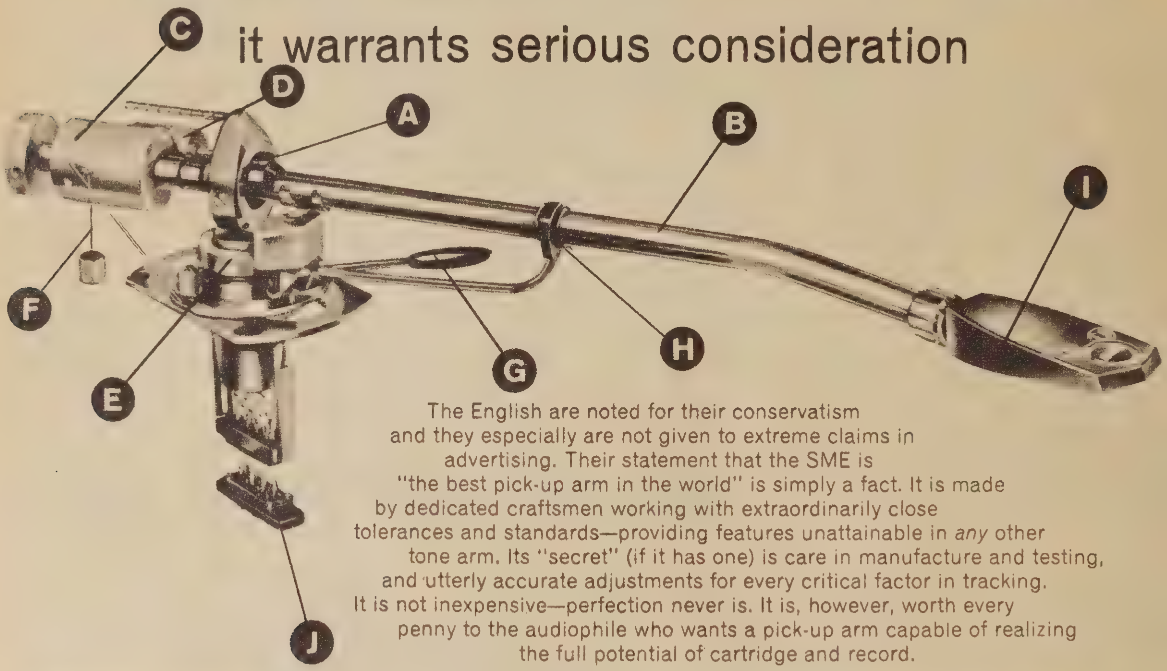
N.S.W.: 443 Kent Street, Sydney 29.1528
VIC.: 368 Little Bourke Street, Melbourne 67.1197
W.A.: 144A William Street, Perth 21.6500
QLD.: 235 Edward Street, Brisbane 2.3247
S.A.: 77 Wright Street, Adelaide 51.5117

GE:P257

when the British say

"the best pick-up arm in the world"

it warrants serious consideration



The English are noted for their conservatism and they especially are not given to extreme claims in advertising. Their statement that the SME is "the best pick-up arm in the world" is simply a fact. It is made by dedicated craftsmen working with extraordinarily close tolerances and standards—providing features unattainable in *any* other tone arm. Its "secret" (if it has one) is care in manufacture and testing, and utterly accurate adjustments for every critical factor in tracking. It is not inexpensive—perfection never is. It is, however, worth every penny to the audiophile who wants a pick-up arm capable of realizing the full potential of cartridge and record.

SHURE SME DESIGN FEATURES

A. Virtually frictionless knife-edge bearings. Pivot friction is less than 20 milligrams, horizontal and vertical!

B. Wood-lined stainless steel tube arm. Resonances are outside recorded range, of small amplitude, and damped.

C. Unique weight system statically balances arm longitudinally AND laterally.

D. Rider weight adjusts tracking force from ¼ to 5 grams, adjustable for ¼ or ½ gm. increments, as accurate as a fine stylus pressure gauge.

E. Sliding base offers alignment adjustment through 1 inch. Height is adjustable through ¾ inch. Fulfills optimum requirements of length, offset, overhang when adjusted with alignment protractor included.

F. "Anti-skating" bias adjuster counteracts tendency of the arm to move toward record center and "favor" inner groove.

G. Hydraulic lever-operated set-down for "slow-motion" feather-light lowering onto any part of the recording.

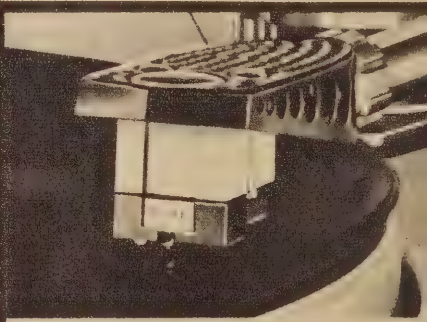
H. Nylon-jaw arm rest with stainless steel locking link.

I. International standard 4-pin socket. Cartridge shells fitted with detachable pillars and mounting screws at standard ½ inch spacing.

J. Output socket and plug provides a rigid junction eliminating influence on free tone-arm movement. Plug-in Cable Assembly included for quick, solderless hook-up.

PRICES: Includes arm, template, alignment protractor, hardware, cable and plug assembly.

MODEL: 3009 for 12in recordings	$77.20
MODEL: 3012 for 16in recordings	$83.00
HEAD SHELLS:	
S.2 Ultra Lightweight	$4.80
S.3 Standard Lightweight	$3.40
D.3 Decca Adaptor (Serial Nos. below 20,000 require weight W/9. W/12)	$7.50
ACCESSORIES:	
C.I. Conversion Kit	$4.20
H.I. Lifting handles for lightweight shells, only	$0.60
P.I. Plinth—increase height of arm	$2.80
Phono Plugs	$0.60



perfect companions!

The Shure V-15 Cartridge in ultra-light shell used with the Shure-SME Tone Arm! Exclusive Bi-Radial elliptical stylus and 15° vertical tracking angle give the V-15 unparalleled performance. Ultra-light shell for Shure-SME permits most effective tracking at minimum forces. Super-light, rugged alloy head has 120 perforations — weighs just 6 grams. Shipped with companion balance weight to match both Shure-SME Pick-Up Arms.

PRICE $88.85

SHURE SME

series 2 pick-up arm

AUDIO ENGINEERS PTY. LTD.

342 KENT STREET, SYDNEY, 26-6731
60 BERWICK STREET, THE VALLEY, BRISBANE, 51-5535

The Darktown Strutters' Ball — Won't You Come Home Bill Bailey — When he Saints Go Marching In — Where he Dog Sits on the Tucker Box — On he Road to Gundagai — Waltzing Matilda. (H.A.T.)

* * *

CAREER GIRLS. Peter Nero, Piano with Orchestra. Stereo, RCA Dynagroove LSP-3313. (Also available in mono.)
Interest: Keyboard artistry.
Performance: Nimble, varied.
Quality: Completely clean.
Stereo: Normal spread.

The idea behind the "Career Girls" itle is so trivial that it's not worth explanation. The music, however, should please those who have an ear for popuar level keyboard artistry that varies from the swinging first track, "The Most Beautiful Girl In The World," to the ingering mood of the next track, "Someone To Watch Over Me." From its Strauss waltz opening, track 3 switches suddenly to a barely recognisable "I Could Have Danced All Night," studded every now and again with glimpses of old "Vienna."

So it goes on, in typical nimble Nero ashion through: "Star Eyes," "A Ceraain Smile," "Easy To Love," "Out Of The World," "Speak Low," "I'm Gonna Sit Right Down," "Career Girl," "Peronality.

Technically, the quality is good and he surface completely free from noise. W.N.W.)

* * *

ROMANTIC ACCORDION. Charles Magnante. Festival, Stereo SNDL 931,804, Mono NDL 31,804. Originally released as a Command Record.
Interest: Virtuoso accordion playing.
Performance: Exciting.
Quality: Excellent.
Stereo: Noticeable separation.

Accordion playing can sound very nediocre, and some of the recordings laced before the unsuspecting public rom time to time are best played once nd then forgotten. All the more welome then is the exciting playing of Charles Magnante on this disc. Mr Magnante is in the virtuoso class with his nstrument, and his performances preented here never flag. Moreover, he lays a special instrument of his own esign with which he is able to obtain ome interesting effects.

For this disc, he has chosen popular unes from the Romance countries, but e word "romance" in the title of the isc has a double meaning here, as a lance at the titles will show. The unes selected by Mr Magnante lend hemselves well to the accordion plus nstrumental group arrangements preented here.

Despite Mr Magnante's virtuosity, I hought the skilful and attractive playing f the group which accompanies him tes as an equal attraction. This consts of two guitars, piano, bass, drums nd a two-man percussion team. Alhough they are never obtrusive, one is ware of the skill with which they perrm their role of accompanying the solo erformer and they come to the fore to how their ability when the accordion is lent from time to time.

Technically the disc is in the "first te" bracket. The stereo is the widely parated variety which suits small enmble performances quite well.

One Note Samba — Always In My eart — Serenata — Andalucia (The reeze and I) — The Girl From Ipanema — Brazil — Meditacao — Romantic Accordion — Amor — O Barquinho — Granada — Patricia. (H.A.T.)

* * *

AMBERWREN AND OTHER FOLK SONGS. Lionel Long with Don Andrews, guitar, and Wally Wickham, bass. H.M.V., Stereo, SCX 07755.
Interest: Australian folk singer.
Performance: Absorbing.
Quality: Excellent.
Stereo: Normal spread.

Congratulations are due all round to those concerned with the production of this fascinating disc: to the performers for their presentation; to the recording engineers for the clean, bright sound; and to E.M.I. for sponsoring this locally made disc and thereby proving that we do not have to look beyond these shores all the time for first-class folk singing.

Undoubtedly the main attraction of the disc is the very long "Amberwren" song which takes up the whole of the first side. I do not know the origin of "Amberwren," and the unhelpful sleeve note does not provide any clues, but my guess is that it belongs to the realms of Irish folklore. The combination of whimsy and allegory certainly seems to be in accord with the Irish temperament. Despite the length of the song and the simple tune which is repeated close to 40 times, Lionel Long's rendering retains attention throughout the 20 minutes' duration of the number. Those who have a taste for fantasy with undertones of allegory will be enchanted with this song.

Local colour is provided on the second side by three songs by Australian composers, including two by Lionel Long himself and a "protest" song by Gordon Tolman about the treatment of Aboriginal artist Namatjira by the allegedly insensitive "lawmen."

The full list of titles on the second side is: I Dreamt of Two Ships — Two Doves — Farewell — Namatjira — Turn, Turn, Turn — Boll Weevil.

The technical quality of the disc is beyond reproach, while the stereo is pleasant without being spectacular. (H.A.T.)

* * *

ST. JOSEPH'S COLLEGE BOYS' CHOIR. Choirmaster Brother Vales. Soloist Valerie Ryan, soprano. Festival, Mono FL-31,834.
Interest: Youthful talent.
Performance: Surprisingly good.
Quality: Good.

St. Joseph's College (a "boarders-only" school at Hunter's Hill, Sydney) has already established a reputation in local performances and eisteddfods for the singing of its boys' choir. This disc shows they are deserving of a wider hearing. It is indeed a surprise to hear the excellent solo and ensemble singing of the choir, which brings to mind the performances of the famous Vienna Boys' Choir. The boy performers show evidence of a sound musical training under expert direction.

In this disc they sing a pleasant selection of familiar and unfamiliar tunes with precision and feeling. There is also some delicious singing (solo and descant) by "guest artiste" soprano Valerie Ryan. Incidentally, anybody who buys this disc will be contributing to two good causes.

EKCO-STYLUS
RADIOGRAM NEEDLES-DIAMOND AND SAPPHIRE

STEREO — L.P. — STD.

- "DI-FI" for HI-FI. The premier Diamond Needle for the Discriminating Music Lover.
- ECKO-STYLUS is the needle with the "Built-in" guarantee.
- A perfect "PARTNER" for your valued records.

Be "EKCO-WISE" — INSIST ON EKCO-STYLUS

Use our Needle Clinic for FREE Inspection.

Enquiries:
ERNEST KUENZLI PTY. LTD.
60 HUNTER STREET, SYDNEY, N.S.W.
TELEPHONE 28-6991

KODAK TAPE . . . THE NAME OF UNIFORMITY

What's in a name? When it's Kodak Sound Recording Tape, a tape by any other name does not sound as sweet. So, pride in a superior product is one reason why we back-print each roll of our tape with a continuous, permanent legend that includes the name "Eastman Kodak Company".

The back-printing, with its cabalistic numbering, serves several useful purposes, too.

It helps to keep the quality of the tape uniform by providing, during manufacture, a continuous quality-control check along the entire length of every roll. It also gives the user very practical and useful data.

The legend tells you at a glance what kind of tape you're using. How thick it is. What the base material is. And by noting whether the imprint reads upside down or right side up, you can quickly tell which track you're using.

The practical help you get with Kodak tape by no means ends with back-printing. If you've ever had the pleasure of using the Kodak Thread-Easy Reel, you'll know what we mean. Here's a reel that takes the fumbling out of tape handling. You simply drop the end of the tape in the slot and you're ready to go. The reel's smooth surfaces, bevelled edges, and dynamic balance treat the tape kindly. And each reel has a built-in splicing jig, index scale, and matte writing-surface on each side.

All in all, the name to look for in tape is Kodak. The place is your nearest Kodak dealer.

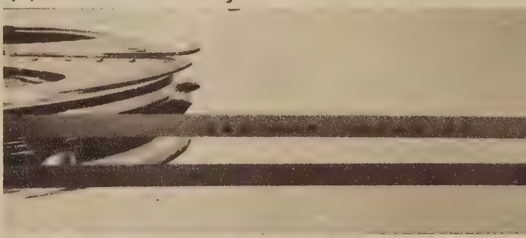
Magnetic Products Sales Division,

Kodak

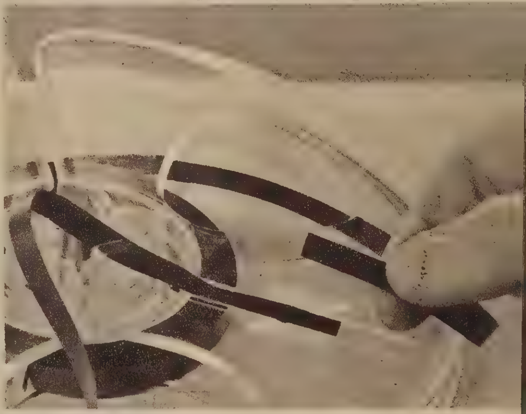
KODAK (Australasia) PTY. LTD.

Branches in all States.

(a) The Thread-Easy Reel in use



(b) Tape showing back-printing



(c) The splicing jig

SAVE $100's with these 3 great new

DO IT YOURSELF volumes

PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA
PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA
PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA
Step by Step to a BETTER HOME

- ★ EASY STEP-BY-STEP STAGES
- ★ ALL THE LATEST IDEAS
- ★ 700,000 WORDS IN 1,600 PAGES
- ★ 2,500 A-Z SUBJECTS BY 15 AUTHORITIES
- ★ 1,000's OF ILLUSTRATIONS ★ EXPLANATORY FULL COLOUR SECTION

Newnes New PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA counteracts the ever-rising cost of repair, maintenance and improvement to your home. It gives you expert, up-to-date guidance in simple language, shows you how to make fitments and built-in furniture, make home extensions. All latest innovations are given: double glazing, central heating, draught-free porches, room dividers. Everything you want for a better home, inside or out. Includes handicrafts for winter months, to save you hundreds of pounds in bills and make your home worth more in hard cash! See this new home handyman today . . . send for Free Examination and use it right away!

3 TIMES VALUE of any other Do-It-Yourself. More Details, More Subjects, it's COMPLETE.

EXAMINE THE 3 BIG BOOKS AT HOME *FREE* FOR 10 DAYS.
Fill in Coupon NOW! No one will call

FREE!
—to every purchaser ABSOLUTELY FREE a Tool Every Home Needs—MULTI - GRIP All - Purpose WRENCH. Beautifully machined, long for easy leverage, tough tool steel for enduring strength. Adjusts for small or out-size nuts; grips and shifts stubborn pipes, shafts, etc., etc.

OFFICE USE

Please send me Newnes PRACTICAL HOUSEHOLDER ENCYCLOPAEDIA without obligation to purchase. I will either return the work within 10 days or I will send the first payment of £1.10.0 11 days after delivery, then 11 monthly subscriptions of £1 until the sum of £12.10.0 has been paid. The cash price within 10 days is £11.15.0. The offer does not apply to overseas purchasers, who should send the cash price of £11.15.0

Mr./Mrs./Miss ....
BLOCK LETTERS PLEASE

Full Address ....
....
....

Occupation ....

Your Signature ....
(Parent to sign if you are under 21)

Tick ✓ where applicable
The address on left is—
My Property ☐
Rented Unfurnished ☐
Rented Furnished ☐
Parents' Home ☐
Temporary Address ☐
Boarding ☐

This coupon is invalid if not signed and all questions answered.

NOW *you can do* every job BETTER, CHEAPER & QUICKER

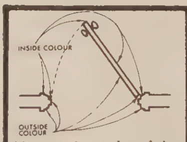
GLAZING. DOUBLE
BUTT JOINTING
BUILT IN FURNI

EVERYTHING YOU WANT TO KNOW ABOUT—

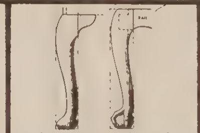
Tiling, Bricklaying and Tools, Cavity Walls, Laying Carpet and Lino, Concrete Mixes, Condensation and Damp-proofing, Roof Repairs, Correct Drainage, Adhesives, Levelling and Painting Floors, Household Pest Control, Home Insurance, Interior and Exterior Decoration, Paint Stripping, Spraying, Painting, Plastering, Plastic Plumbing, Power Tools, Radio and TV Faults, Car Maintenance, Draught-proofing, Electric Wiring, Brickwork, Colour in Decorating, Lighting effects, and so much more—a veritable mine of practical data you need today as never before.

THESE PUT EXTRA VALUE ON YOUR HOME—

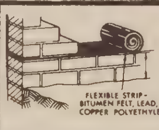
How to Build a Breakfast Bar. Fuel Bunker. Built-in Furniture. Corner Bookcase. Incinerator. Terrace, Drive-way. Front-door Canopy. Covered Way. Dining Serving Hatch. Bathroom Cabinet. Continental Bedheads. Burglar Alarm. Dropside Cot. Laundry Cupboard from wasted space . . . a thousand and one aids to make a cosy home.



How to decide colours for each side of door.



Joinery tricks for chairs and all woodwork.



Bricklaying, damp courses, maintenance, etc.

MAIL THIS POST PAID CARD TODAY

CUT OUT ALONG DOTTED LINE

Authority
No. 336
WELLINGTON

BUSINESS REPLY POST

Postage will be paid by

GEORGE NEWNES (NZ) LTD.,

99 THE TERRACE,
P.O. BOX 520,
WELLINGTON, C.1

e proceeds from sales will be shared tween a fund for building a new sixth-ar building for the college and the eedom From Hunger Campaign.

The program presented by the choir Joshua Fight De Battle of Jericho Ward Ein Blumchen Mir Geschenkt Zwa Sternderl (A Star of Heaven) Ave Maria — Aba Heidschi — ome Back Liza — Do Re Mi (from und of Music) — Ramblin' Rose — um-Ba-Ya — Don't Be Afraid. [.A.T.)

* * *

ITS OF THE 60s — The Four Lads. Universal Record Club. 12-inch mono. UP-671.

Interest: Pop vocal quartet.
Performance: Lively, smooth.
Recording: Fine.

The well-known pop vocal group The ur Lads are featured on this disc nging their recent hits. They reveal a ely but smooth style, making even ell-worn tunes seem more interesting.

The tunes featured are: Exodus — e'll Have To Go — Calcutta — Theme om A Summer Place — Michael — g Bad John — Moon River — Are u Lonesome Tonight — Never on nday — Chapel By The Sea —Wooden eart, and Morgen.

The recording is fine. (J.R.)

* * *

IE BEST OF JOLSON. Vocal with orchestra. Two-record album in box. Stereo, Festival SDL-930,969 and SDL-930,970.

Interest: The inimitable Al Jolson.
Performance: Characteristic.
Quality: Satisfactory.
Stereo: Simulated.

I can't imagine too many people want-g to play 28 tracks of Al Jolson at e one sitting but, so numerous are his mirers and the songs with which he identified, that many may be tempted this two-record set.

Record 1 contains: Swanee — You ade Me Love You —When The Red, d Robin — Four Leaf Clover and byface — Sonny Boy — Rainbow und My Shoulder — Toot, Toot, otsie — April Showers — Rockabye ur Baby — She's Makin' Eyes at e and Dinah — Liza — Carolina In e Morning — I Wish I Had A Girl.

On record 2: California, Here I Come Ma Blushin' Rosie — My Melancholy by and My Blue Heaven — My ammy — Margie — Let Me Sing And Happy — When You Were Sweet teen — Anniversary Song — If I Only d A Match — Easter Parade — out A Quarter To Nine — Ol' Man ver — She's A Latin From Manhattan I'm Always Chasin' Rainbows.

Apart from the vague statement that me of the tracks come from Kraft usic Hall series of radio shows, no empt has been made to document em in relation to date and orchestral cking. However, those responsible ve managed to keep them fairly even their general balance. Here and ere, the effort to achieve this has re-lted in a slight edginess from boosted ble or a trace of hum from boosted ss but both are well inside the toler-ce that one normally extends to -issues of that kind.

Don't attach too much significance to "stereo" labelling, however, because is of the simulated type with the ble predominating in one channel and bass in the other. But, if you're a lson fan, you won't be arguing about is. (W.N.W.)

BECAUSE. Jan Peerce, vocal with orchestra. Mono. RCA Gold Standard 45EP 20,345.

Interest: Famous singer.
Performance: Excellent.
Quality: Varies.

As with the Nelson Eddy disc reviewed recently this one contains four old "chestnuts" but, equally, four notable performances of them: Bless This House — Because — I Love You Truly — Oh, Promise Me.

The first and third of the numbers have a relatively wide-range sound, the other two being somewhat restricted by comparison but nevertheless perfectly acceptable.

Well worth considering for your collection. (W.N.W.).

* * *

WARATAHS AND WATTLE. 15 songs Of Australia. Kathleen McCormack, vocal with orchestra. Stereo, RCA SL-101,674. (Also available in mono L101,674).

Interest: Australian songs.
Performance: Notable.
Quality: Good.
Stereo: Modest.

In the January issue, I spoke very favourably of another LP by Kathleen McCormack, "Waltz Songs Of The Twenties." This one, though quite different in character, earns similar commendation. Kathleen McCormack, though Irish born, has spent most of her life in this country and has become something of a specialist in Australian folk songs. With excellent diction, presence and musicianship, she communicates, here, a real interest in the songs.

Commendable, too, is the instrumental backing, which is not surprising considering the musicians who provide it: Don Andrews, guitar; George Golla, guitar and banjo; Reg Robinson, bass; Herbie Marks, accordion and virginals; Don Burrows, flute; Lal Kuring, cello. Production is by Ron Wills.

The generous program of 15 titles includes: The Ballad of Starlight — Miss Abilene — The Swagman's Song — Kiss In The Ring — Joseph Holt — The Shiralee — Bonnie Jess — The Three Drovers — Thunderbolt — Dreamtime Lullaby — Ben Boyd — Buster The Swagman's Daughter — Mrs Swaggie Joe — Two Little Boys — Waratahs and Wattle.

The album may disappoint those who prefer bush music of the more primitive kind, but personally, I'll settle for the Kathleen McCormack formula, with Don Burrows' flute and the rest of the ensemble in support. (W.N.W.).

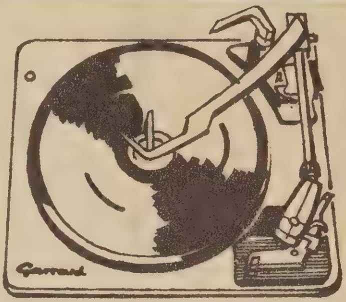
* * *

SOMETIME LOVIN'. Sean and Sonja. CBS Mono, BP 233264.

Interest: Australian folk-singing duo.
Performance: Promising.
Quality: Fair.

Sean and Sonja show promise of developing into a good folk singing team, but are not yet in world class. They sing pleasantly enough and the guitar accompaniments are moderately good but, in their performances on this disc, the essential ingredient of musicianship is still lacking. The discerning listener will find evidence of this in their phrasing, which tends to be ragged, and their timing which is a little out here and there.

Garrard
TURNTABLES
Garrard



U.R.D. extend an invitation to call and inspect the new and complete range of Garrard Turntables — from the budget priced economy model SRP10 (complete with Ronette Cartridge) at **$24.62** or **£12.6.3** through to the world-renowned Model 401 Transcription Unit (with stroboscopically etched periphery) as used by the B.B.C. . . . at **$153.92** or **£76.19.3.**

* * * * *

In addition, stocks of all leading makes of quality equipment are always available, including such famous names as:

Quad	**Tandberg**
Radford	**Leak**
Trio	**Rogers**
Sony	**Pioneer**
Dual	**Thorens**
Labcraft	**All Balance**
S.M.E.	**Decca**
Shure	**A.D.C.**
Ortofon	**Ferrograph**

and others, together with a complete range of SCOTCH Magnetic Recording Tapes.

* * * * *

Plus Speaker Enclosures and Equipment Cabinets suitable for the above.

Hire Purchase Facilities Available

URD

Full technical information & illustrations on request.

UNITED RADIO DISTRIBUTORS PTY. LTD.
175 Phillip Street, Sydney
Telephones: 28.3718, 28.3926
OPEN SATURDAY MORNINGS
Sydney's leading High-Fidelity Specialists

LOOK AT THESE . . . SPECIAL OFFERS FOR MARCH — UNBEATABLE VALUE

ARMSTRONG 221. Integrated Stereo Amplifier (illustrated above).

The 221 Amplifier is designed for use primarily with magnetic pickups but inputs are also provided for the higher output ceramic and crystal pickups.

At its price the 221 represents a major breakthrough in high fidelity amplifiers. Never before has an amplifier of this quality, sensitivity and power, incorporating all these facilities, been available in this price range.

1 Armstrong 222, integrated Stereo amplifier. Power output, 10 watts push-pull. Frequency response—30-20,000 c.p.s. 1 dB Power Response, 35-20,000 cps. 1dB. Harmonic distortion less than 0.5 per cent at 1K c measured at 8 watts output 1dB. Decca Deram diamond needle. 2 Goodman 8in twin-exiette speakers or 2 Wharfdale 8in RS DI super speakers, Garrard AT6 turntable. Price **£109**

2 Armstrong 226 tuner amplifier FM Broadcast, 12 watt per channel, world's best Stereo equipment. Famous German made P.E. 34 hi-fidelity turntable with belt driven, hydraulically controlled, built-in lowering device. Incorporating diamond magnetic cartridge, 2 Goodmans twin-exiette speakers, 10in. Price **£180**

3 Armstrong 221 — illustrated above, integrated Stereo amplifier with magnetic pick-up inputs. Dual 1009 with B and O diamond magnetic cartridge. 2 Wharfedale 8in Super RS. DD speakers. Price **£137**

4 Truvox stereo amplifier, 2 Goodmans 10in twin-exiette speakers Dual 1010 with pickup, Price **£140**

5 Leak Stereo 30 amplifier, 2 Wharfedale Super 10in RS/DD speakers. Dual 1009 with Empire 888 cartridge. Price **£186**

6 Pioneer 204B amplifier, 2 Goodmans Maxim speakers, Dual 1010 turntable, with cartridge. Price **£170**

7 Well known Star SA 30, P.E. 34 turntable with B and O diamond magnetic cartridge. Price **£85**

8 EMPIRE—world's most perfect cartridge—Model 888. Frequency Response: 12-24,000 cps. Compliance: 10X10-6 cm dyne. Stylus Type: .7 mil diamond. Model 888P. Frequency Response: 20-28,000 cps. Compliance: 15X10-6 cm dyne. Stylus Type: .6 mil hand polished diamond. Model 888P.E. Frequency Response: 8-30,000 cps. Compliance: 20 x 10-6 cm/dyne Stylus Type: .2 x .9 Bi-radial elliptical diamond.

We will care-pack and freight anywhere. If the goods you require are not listed write for our prices—you'll be delighted! R.M.S. are famous for selling the best quality equipment, and indisputably the cheapest in Australia.

RECORDED MUSIC SALON

C. PINCZEWSKI

TRUE FIDELITY

23 COLLINS STREET
MELBOURNE
Telephone: 63-6257

WHOLESALE AND TRADE ENQUIRIES WELCOME

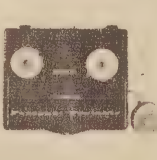
NEW IMPROVED 30 WATT

12v. All Transistor P.A. AMPLIFIER

No. 598—Complete Kit of parts to smallest screw, $55. No. 656 — Wired ready to operate, $60. Freight extra. Size: 6in w. x 3in h. x 8¼in d. Weight 6½lb.

PERSONAL PORTABLE

2 TRANSISTORS



Range 30 miles, 200 with short aerial and earth. Earpiece only, no speaker. Wired ready to use, No. 666D, $10.
Postage 20c.
Do-it-yourself kit, No. 666C, on app.

COILS & IF's 455 Kc

Aer, R.F. osc. and IF's . .. $1.70 ea.
Ferrite Aer . . .. $2.
Postage 10c. Write for details and price Part 265 Universal Tape OSC coil, $6.

PRE AMPLIFIER
6 transistor
2 (silicon)

For 5 watt amplifier with panel and knobs, Stereo do-it-yourself kit No. 616C, $25.80. Postage, 20c. Mono, do-it-yourself kit No. 616AC, $15 Postage 10c.

Write for data sheets.

Printed circuit mono, or stereo No. 616 .. ..$3
Postage 10c each.

5 watt stereo power supply. Do-it-yourself kit No. 681C, $16 Printed circuit No. 681, $2.50. Postage 681C, 80c; 681, 10c.

PRINTED CIRCUITS

From your drawings. Price: $10 set up charge plus 30c for each print 5 sq. in. and under. For prints over 5 sq. in., add 2c per sq. in. Drilling, plating, coding, price on application.

NEW!
LOW PRICE!
QUALITY CONSTRUCTION!
PEAK RECEPTION!

R.C.S. COMPLETE DO IT YOURSELF KITS

● No expensive test equipment ● Everything fits.
1964 RF Transporta 7. Complete kit—No. 640: $43.50. Portable car radio, identical to 640 above, plus extra switch and car coil. etc. No. 642: $46.
(Write for booklet on 640 and 642.)

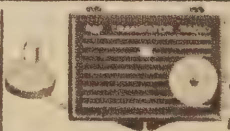
3 TRANSISTORS HI-FI MULLARD FIVE WATT AMPLIFIER

Frequency response—30 cycles to 18 KC, 3 DB. Distortion — one half of one per cent or better. Input—125 MV, 1,000 ohms impedance. DC supply—22 volts 0.8 amps, speaker 15 ohms. Size: 5¾in long x 4in high x 3in deep.

Do-it-yourself kit 675C $17. Postage 30c.
Write for blueprint data.

IMPROVED BATTERY SAVER KIT

4½, 6 or 9 volts. Replaces transistor battery power input 240 volts A.C. Maximum milliamps 100. Hum-free operation. Size 3½in l. x 2½in w. x 1½in h. No. 657, $6.50 (post 10c).



PERSONAL TRANSISTOR

1 Transistor,
1 Diode.

No. 582—Do-It-Yourself Kit of Parts for above, $5.
No. 593—Wired ready to operate. $6.
Postage 582, 593 10c. No C.O.D.s.

NEW PRINTED CIRCUITS

Part No.		
675	H-FI FIVE WATT amplifier	$2.50
677	Fairchild 3/5 watt amp.	$2.50
678	Electronics audio generator ..	$2.40
679	Volt meter E'tronics 65. M.9	$2.50
684	Preamp.—Electronics 65/P12A	$2.50
684	Preamp. Electronics 65 P.10 .	$2.50
686	Preamp.—Electronics 65/P12B	$2.50
687	Preamp.—front panel 65/P12	$.250
580	Car Radio	$3.50
591	30 W.P.A. Amplifier	$3.50
606	Mullard 10/10 Stereo, pr. ..	$6.50
608	Mullard WB Tuner	$3
669	R. and H. Tape Recorder	$3.20

Sales Tax included. Postage 10c. We can supply any R.H. Printed Circuits.

NEW AUDIO AMPLIFIER

4 transistors. ½ or 1 watt. Small size: cabinet 3" x 2" x 1" plastic. Suitable crystal P./up, intercom., microphone radio, etc. (9 volt)
Do-it-yourself kit 665, $10 (Post 10c).
Wired ready for use, 665D; $11.50.

THREE NEW TRANSISTOR PREAMP KITS:

LOW IMP. input 2 trans. 672C $6.50
Wired ready for use, 672D $8
HIGH IMP. silicon 2 trans, 680C ..$6.50
Wired ready for use. 680D $6
HIGH IMP. silicon 3 tran. 682C ..$7.50
SIZE 3 x 2 x 1in 2 req. for Stereo.
Wired ready for use. 682D $9
Postage 10c each. Write for data.

Order by Mail Cheque, Postal Note or Money Order (add post), direct to:—

R.C.S. RADIO PTY. LTD., 651 FOREST ROAD, BEXLEY, N.S.W. 58-3491, 58-5385.

Dne might argue that this degree of esse is out of place in folk singing, l those interested in the local brand folk singing, in particular the not insiderable following which this young uple seem to have acquired, will no ubt welcome this new addition to the cal repertoire.

Technically, I can give the disc only "fair" rating, because, although the und is generally clear and bright, mething seems to have gone wrong ring the recording process which relts in the sibilants being over-emphaed.

The Dove — A-Roving — First Time er — Hieland Laddie — Spinning heel—The Young Birds — Sometime vin'—The Bells of Rhymney—T'was etty to be in Balinderry — Whistle, aughter, Whistle—O Waly, Waly — ork of the Weavers—Go Lassie Go. .A.T.)

★ ★ ★

IE STREETS OF LAREDO. Eddy Arnold, Vocal. Mono, RCA 45EP 20342.

Interest: Cowboy songs.
Performance: Pleasant.
Quality: Typical mono.

Eddy Arnold's performance of "The reets Of Laredo" which I heard first an RCA stereo sampler, is the one at manages to make most others und quite inadequate. And he turns here excellent accounts also of "Cool ater" — "A Cowboy's Dream" — Carry Me To The Lone Prairie."

A pleasant collection of cowboy ngs. (W.N.W.)

POPULAR JAZZ

UKE ELLINGTON AND JOHN COLTRANE. Also featuring Elvin Jones, Aaron Bell, Jimmy Garrinson and Sam Woodyard. Mono. Universal Record Club. UJ689.

Interest: Modern jazz.
Performance: Marred.
Quality: Excellent.

This disc was originally released on e Impulse label and a review appeared the August, 1963 issue.

In the original review I expressed the inion that John Coltrane's style of exnded free blowing did not seem to agree ith Ellington's style of piano playing. nce then I have listened to the disc any times, mainly for the Duke's piano los, and I still feel that Coltrane is dd man out, marring the final performnce.

The audio quality of the disc is as xcellent as was the original Impulse lease. (K.W.J.)

★ ★ ★

ALL ME MISTER. Featuring Mr Acker Bilk and his Paramount Jazz Band. Mono, Encore, 330EX-9163.

Interest: English jazz.
Performance: Smooth, polished.
Quality: Excellent.

Despite that ridiculous bowler hat, andy striped vest, clowning antics on age and a much-publicised term in aol, there is no doubt that Acker Bilk an play really good jazz. Perhaps he as learnt, as have others before him, hat it is not enough to be merely a ood musician. If you want to go places a hurry you must also have a gimmick. In this disc the Bilk boys show that, gimmicks or not, they can play polished jazz and in a variety of styles from New Orleans to Chicago and the East Coast. The track titles are: Manana Pasado Manana — South — Trinidad Dad — Baby Brown — When You Smile — One Sweet Letter From You —On The Sunny Side Of The Street — Black Label Blues — Down In Honky Tonk Town — Home — Climax Rag.

For those who care about such things the audio quality is really first class with a nice balance between performers throughout. (K.W.J.)

★ ★ ★

I LOVE JAZZ! Louis Armstrong and the All Stars. Stereo, Festival, SDL-931,769. (Also available in mono, DL-31,769).

Interest: Satchmo.
Performance: Typically excellent.
Quality: Fair.
Stereo: Fair.

There are now so many Armstrong releases that it becomes increasingly difficult to find words for a new one. This latest disc features tracks cut between 1950 and 1958 and features Satchmo with such illustrious jazzmen as Peanuts Hucko, Trummy Young, Billy Kyle, Barney Bigard, Charlie Shavers, Omer Simeon, Jack Teagarden, Earl Hines and Cozy Cole.

Track titles are as follows: I Love Jazz — Twelfth Street Rag — Basin Street Blues — Skokiaan — Frog-I-More Rag — Otchi-Tchor-Ni-Ya — Tenderly — You'll Never Walk Alone — Pretty Little Missy. For those who like Armstrong this is all good stuff and something of a collector's item, since many of the tracks have never before been released in LP form.

The audio quality of this one is only fair, as is the stereo which, on most tracks, is of the simulated kind and lacks real spread. (K.W.J.)

★ ★ ★

THE BE BOP ERA. Featuring the groups of Coleman Hawkins, Illinois Jacquet, Lucky Thompson, Kenny Clarke, Charlie Ventura, Count Basie and Dizzy Gillespie. Mono, RCA Vintage Series, LPV-519.

Interest: Historical Bop.
Performance: Generally good.
Quality: Late 40's vintage.

The Be Bop era, which began in the early 40s and merged into later musical trends in the early 50s, was something in the nature of a revolt by musicians against the soggy rhythms and arrangements which commercialised music and Tin Pan Alley had created.

In Be Bop, musicians were attempting to reassert their individuality and creativity and, despite opinions to the contrary, Bop was a form of jazz. It was a form, however, which never gained wide popularity because the melodies were, in the main, developed from complex harmonised cadences intensified by the use of chromatic passing chords and altered harmonic intervals. Such music was a little too sophisticated for the public ear.

Interest in this disc, then, might be limited to musicians and jazz enthusiasts but for these people it would have great historical interest, particularly the tracks by Dizzy Gillespie. It is not all good Bop but about 80% is and, for the enthusiast, that is worth having.

The audio quality is only fair to average, since many of the tracks were taken from original 78 r.p.m. releases. (K.W.J.)

If you want
STEREO
EQUIPMENT
You'll deal better with
H. B. RADIO PRODUCTS

Cabinets for equipment and speakers at FACTORY PRICES are available from stock or we'll make to your order.
You will find our value terrific on Amplifiers—Stereo, radio chassis—players—speakers—tape decks.

MARCH SPECIALS

Trio STEREO AMPLIFIER, 20 watt R.M.S. £58 $116. Linmark stereo amplifier 8 watts and two 8 W.R. speakers £27 $54 also available Pioneer SMB161, SM83, SMQ300, Star.

NEW D.P. SLIMLINE enclosure to suit 10in and 12in speakers, 26 x 18 x 7¼, £9/5/, $18.50 Cabinet Kit only, £5/5/, $10.50 .. .. $10.50
MAGNAVOX or ROLA design slimline cabinet with 8 WR or 8 MX speaker fitted, £12/12/6, $25.25. Cabinet Kit only, £5/5/,

GARRARD AT6 PLAYER (with diamond stylus) ON PLATFORM £20/10/. AT60 with Decca Deram £4/10/ $9.00 Extra Perspex cover £5/10/-, $11.00

GOODMANS design 3 CF cabinet with tunnel, and Twinaxiom 10 speaker, ¾in material .. .. £27, $54 Cabinet Kit only, £8/10/, $17
WHARFEDALE design 3 CF cabinet (R3) and Golden 10 speaker, ¾in material, £27/10/, $55. Cabinet Kit only, £8/10/, ... $17
Available in Maple, Walnut or Rosewood colours. Teak veneer. 10/- extra except last 2 which are 30/- extra.

PLAYMASTER Bookshelf Speaker System Complete, $30
Cabinet kit only, £3/10/, $7
All other parts including speakers, inner board, etc., £7/15/, $15.50.
Postage N.S.W. [illegible], Qld., Vic., Tas. $1.40, other States [illegible]

Write for Stereo Catalogue
H. B. RADIO PRODUCTS
Manufacturers of Quality Radio and Radio Furniture for 36 years.
103-105 Catherine Street,
LEICHHARDT, SYDNEY.
Telephone: 56-5580

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

PHONE 51-3845

RADIO

136 VICTORIA ROAD, MARRICKVILLE, SYDNEY,
AND 636 KING STREET, NEWTOWN—51-7008

136 VICTORIA ROAD, MARRICKVILLE — 51-3845

AUSTRALIAN DISTRIBUTOR

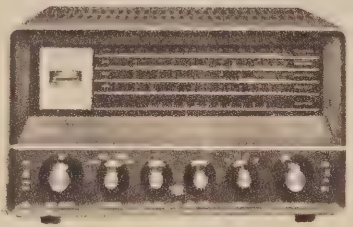
TRIO

ACCREDITED SERVICE DEPOT

COMMUNICATION RECEIVERS
TEST EQUIPMENT - AMPLIFIERS

WORLD FAMOUS COMMUNICATIONS RECEIVERS

J.R. 200 D.X. DELIGHT

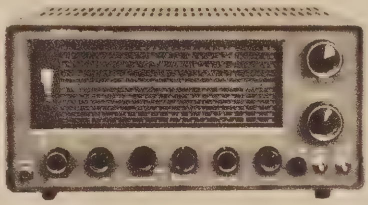


7 Valve. 4 Band. 550 K.C. to 31 Megs. A.M. and C.W. Bandspread. A.N.L. B.F.6. A.V.C. M.V.C. S Meter. R.F. Stage. 240 V. 50 Cycle.

$99.00 £49/10/-

Also available in kitset £44/10/.

9R. 59 AMATEUR SPECIAL



9 Valve. 4 Band. 540 K.C. to 30 Megs. Electrical Bandspread. Variable Selectivity. Q Multiplier. A.N.L. A.V.C. M.V.C. S Meter. B.F.O. R.F. 82-IF. Stable Osc. For SSB.

$135.00 £67/10/-

J.R. 60 PRO-AM & S.S.B. V.H.F.

14 Valve. 5 Band. 540 K.C. to 30 Megs. Plus 48 to 54 Megs. Double Conversion. Electrical Bandspread. Variable Selectivity. Q Multiplier. A.M. C.W. SSB. F.M. Crystal Calibrator. A.N.L. A.V.C. B.F.O. Product Detector. Gated Beam. F.M. Det.

$215.00 £107/10/-

TRIO STEREO AMPLIFIERS

W-41U

9 valves. 20 watts. 20-20,000 cycles per channel. Input for tape. Mag. and crystal P.U.

$110.00 £55/-/-

WE-24

7 valves. 12 watts per channel. Input for tape. Mag. and crystal P.U. Direct coupled circuit. 20 to 20,000 cycles. Within ½ D.B.

$95.00 £47/10-

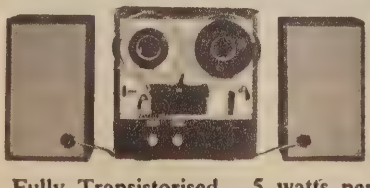
TRIO 2 METER OR 6 METER CONVERTORS

Locked crystal. Low noise cascode circuit.

$45.00 £27/10/-

PAROS

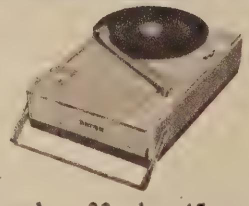
P.14 STEREO 4 TRACK HI-FI RECORDER



Fully Transistorised. 5 watts per channel. 3 Speed. 40 to 15,000 CPS. Complete with 2 Mics., Tape and Spools. 2 Speakers. 240V A.C. Powered.

$230.00 £115/-/-

TRANSISTOR PORTABLE RECORD PLAYER P.500



2 Speed. 33 plus 45. Inbuilt battery. ½ watt Output.

$33.50 £16/15/-

A.C. Power Supply available (£3/10/ extra)

TRIO W.O.1 SWEEP GENERATOR

TV and F.M. 2 to 260 Meg. Sweep 0 to 20 Meg. Ideal for TV Sound and Picture Aligning.

$99.00 £49/10/-

TRADE REVIEWS AND RELEASES

PULSE GENERATORS FROM U.S.A.

FREQ RANGE
DELAY
WIDTH
RAMP RATE/DIV
OFFSET
AMPLITUDE
POLARITY
NORMAL
ATTENUATOR
SINGLE CYCLE
DRIVE INPUT
PULSE MODE
SINGLE
DOUBLE
GATE INPUT
TRIGGER
OUTPUT
WIDTH
POWER
MODEL 139B
PULSE GENERATOR

A recognised world leader in the pulse generator field, E-H Research Laboratories Inc. of Oakland, California, U.S.A., is now represented in Australia by Amalgamated Wireless (Australasia) Limited.

Realising the need for improved pulse generator techniques, E-H entered this field in 1958 and undertook the design and manufacture of research and nuclear instrumentation. In 1959 E.-H introduced the first nanosecond pulse generator; in 1960, the first pulser with 10MC repetition rate as well as the industry's first switching time meter. In 1961, E-H introduced the first 50V nanosecond pulse generator and, in 1962, the first 200MC sub-nanosecond pulse generator, thus entering the microwave field. In 1963 came the first 50V all-solid-state pulser and, in 1964, the industry's first 200MC repetition rate nanosecond pulse generator and the first high-repetition rate 200 picosecond generator.

The usefulness and versatility of pulse generators as laboratory and system tools is perhaps not generally appreciated. Besides the obvious applications in digital and non-linear systems and as modulation devices, they can accomplish many other functions more quickly and easily than conventional methods, e.g., for analysis and design of pulse-code modulation systems and for resolution tests of counters, scalers, coincidence circuits, and other time-difference sensing devices.

The range of these pulse generators provides repetition rates from 10cps to 200MCs and pulse widths that are continuously variable from 20 nanoseconds to 500 microseconds. They will also provide a variety of risetimes from less than 1 nanosecond to 3 milliseconds.

Brief specifications for typical instruments from the range of E-H pulse generators at present available from A.W.A. follow.

Model 123A:

Repetition Rate: 1KC to 20MC.

Amplitude: 50V into 50 ohms.

Duty Factor: Greater than 50 per cent at all repetition rates.

Waveshape: Less than 5 per cent p-p pulse top aberration at 50V, either polarity. Less than 6 per cent p-p at 25V.

Attenuator: Up to 100:1 in 1/2/5 steps, plus 2.5:1 vernier.

Risetime: Less than 7ns, either polarity.

Width: 20ns to 300us, continuously variable.

Delay: 50ns to 100us, continuously variable.

Trigger Jitter: Less than 0.1 per cent + 50 ps.

Model 139B (illustrated):

Repetition Rate: 10cps to 50MC.

Amplitude: 10V into 50 ohms, either polarity, 3:1 vernier plus 1/3/10/30/100 attenuator.

Offset: Variable to 2V, either polarity.

Duty Factor: Greater than 50 per cent.

Waveshape: Less than 5 per cent p-p all forms of distortion.

Risetime: 6 ns to 3 ms rise and fall, independently, variable ramps. Linear to better than 5 per cent all settings.

Width: 10ns to 10ms, continuously variable.

Delay: 10ns to 10ms, continuously variable.

Trigger Jitter: Less than 0.1 per cent + 50ps.

Model 133A:

Repetition Rate: 1KC to 5MC.

Amplitude: 50V into 50 ohms.

Duty Factor: Greater than 50 per cent at all repetition rates.

Waveshape: Less than 3 per cent p-p pulse top aberration at 50V, either polarity.

Attenuator: Up to 100:1 in 1/2/5 steps, plus 2.5:1 vernier.

Risetime: Less than 10ns to 10us. Rise and fall independently variable ramps. Leading edge linearity better than 3 per cent below 30ns, better than 2 per cent for all other ranges.

Width: 50ns to 300us, continuously variable.

Delay: 75ns to 100us, continuously variable.

Trigger Jitter: Less than 0.1 per cent + 50ps.

Further information about the E-H range of pulse generators is available from Amalgamated Wireless (Australasia) Ltd., Engineering Products Division, 47 York Street, Sydney.

AKAI AMPLIFIER

Akai, of Japan, has entered the audio amplifier field with the Model AA-5000, an all-transistorised pre-main stereo amplifier. Although we have not seen the unit, the specifications are impressive, and the amplifier has obviously been engineered to further the reputation for high quality established by the Akai company in the tape recorder field.

Although designed as an integral unit, all the pre-amplifier components are separately housed and arranged in a compartment mounted above the power amplifier section. In all, 28 transistors and six diodes are used. Silicon power transistors are used for the final stage. Facilities provided include direct reproduction from tape head via equaliser, headphone jack, and switched filters for high and low frequency attenuation in addition to normal bass and treble controls.

SPECIFICATIONS:

Rated Power Output: 70W into 8 ohms, 46W into 16 ohms.

Distortion: 1 per cent at 1KC.

Frequency Response: 20-35,000cps ± 1DB.

Sensitivity: (for 1KC/8 ohms rated power)

Tape Head: 1.5 mV, residual noise below 30mV.

Phono: 3mV, residual noise below 30mV.

Tuner: AUX. and Tape Monitor: 400mV, residual noise below 15mV.

Tone Control: CR type, bass 50cps ± 14dB treble 10KC ± 10KC.

Low Filter:—8dB at 50 cps.

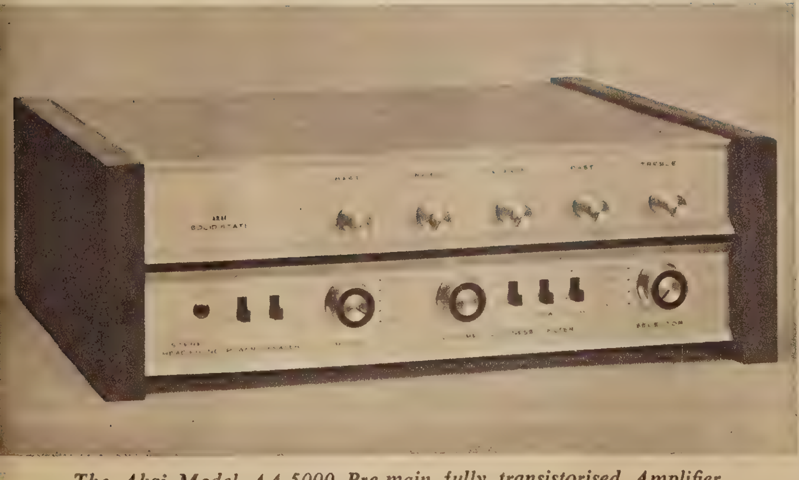
High Filter:—8dB at 10KC.

Equaliser: NF type. RIAA for Phono, NAB for tape head.

Power Consumption: 17W at non-signal state, 160W at full volume state.

Dimensions: 17"W x 5¾"H x 10⅝"D.

The Akai AA-5000 will be available early April from the Australian agents, Magnecord Australasia Pty. Ltd., 158 Clarence Street, Sydney. Retail price will be $298 (£149).



The Akai Model AA-5000 Pre-main fully transistorised Amplifier.

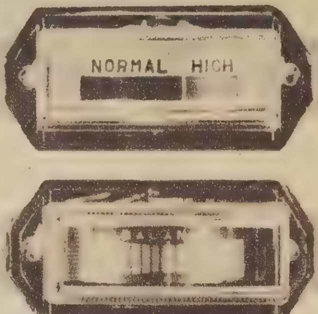
TRADE RELEASES—IN BRIEF

AMALGAMATED WIRELESS VALVE CO PTY. LTD. has provided information about new additions to the English Electric Valve Co. range of precision display tubes for radar, Types T963D and T970Z, and for TV viewfinder, Type T960W.

The 12in T963D cathode ray tube has been specifically developed to meet the demand for a tube capable of handling either alpha-numeric or processed radar displays. It is said to provide a flicker free, high brightness "readout" without degrading the high degree of resolution obtainable. The tube uses the EEV Type D phosphor, which has a light decay curve characterised by an appreciable plateau region preceding fall-off, permitting freedom from picture flicker even when signals at repetition rates of 10 cps or less are fed to the tube. T963 is also available with EEV Type Y or Z screens.

The 16in T970Z cathode ray tube is basically a larger version of the T963D. Despite the greater overall length and increased magnification ratio, the line width does not exceed 0.35 mm. The electron gun has been designed to deliver the same electron density at the screen as the smaller T963D, so that the two tubes have equal brightness.

The T960W monitor CRT when used as a TV camera viewfinder provides a bright enough picture to allow the operator to dispense with a viewing hood. It measures 9¼in long overall by 6in across the screen diagonal. The makers claim the optical resolution is more than adequate for 625 line TV displays. (Further details available from Amalgamated Wireless Valve Co. Pty. Ltd., 47 York Street, Sydney or state branches.)



ELECTRONIC SUPPLIES, of Box 417, PO., Crown Street, Sydney, make available a wide range of imported low-cost meter movements. Illustrated are two movements from the range, both edge-type for use where panel space is at a premium. One has a two-colour volume level scale for tape recorders and other audio applications, while the other has a centre-zero stereo balance scale. Many types of square and round dial meters with various sensitivities and scale are also available. They may be obtained direct from Electronic Supplies or ordered via local parts suppliers.

SELECTRONIC COMPONENTS, of 6 Central Avenue, Boronia, Victoria, have been appointed Australian agents for Channellock tools, made by the Champion DeArment Tool Co., of U.S.A. A brochure to hand described the range of Channellock electronic pliers which have been specially designed for electronics work. The range comprises a flat nose plier, round nose plier, diagonal cutter and end cutter in the long-reach style (8in or 7½in long) and a set of precision pliers about 4½in long. Another useful Channellock device described in the brochure is the Heat Sorb Clamp, a specially designed heat sink for preventing damage to electronic components during soldering operations. Selectronic Components say these tools will be available through the usual trade channels shortly.

STANDARDS ASSOCIATION OF AUSTRALIA invites constructive comment on the following draft Australian standards, relating to semi-conductor devices:

Doc. 1012. Essential ratings and characteristics of low - power small - signal diodes and transistors (proposed endorsement to I.E.C. Pub. 147-1).

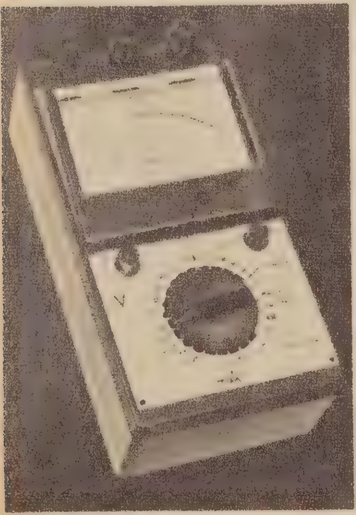
Doc. 1013. Essential ratings and characteristics of voltage reference and voltage regulator diodes and power transistors (proposed endorsement to I.E.C. Pub. 147-1A).

Doc. 1014. General principles of measuring methods (proposed endorsement of I.E.C. Pub. 147-2).

Doc. 1015. Letter symbols for semiconductor devices (proposed endorsement of I.E.C. Pub. 147-2).

Copies of the documents, which are reproductions of the texts of the relevant I.E.C. publications, are available from S.A.A. headquarters, 157 Gloucester Street, Sydney, or from branch offices at Newcastle, N.S.W. and in capital cities. Comments should reach the association not later than April 30, 1966.

WARBURTON FRANKI LTD. have announced that from February 1, 1966, a life-time guarantee will apply on all International Rectifier zener diodes, glass, top hat, flangeless and stud mounted types from 250 mW to 50W, including Jedec or house-



SAVE TIME

ON HIGH IMPEDANCE TRANSISTOR CIRCUITRY WITH UNIGOR 4S MULTIMETER

MODERN APPROACH TO SERVICING. NO WARM-UP TIME IS NEEDED. 30 MEASURING RANGES. WEIGHT APPROX. 3 LBS. DIMENSION 8¼ x 4¼ x 3¼".

100,000 Ω/V on DC
20,000 Ω/V on AC

Unigor 4s

MULTIMETER
Model 226214

Voltage	dB²)	Internal Resistance DC	Internal Resistance AC	Current DC	Voltage Drop appr. V
5,000 V		500 MΩ		1 A	0·35
1,000 V		100 MΩ	20 MΩ	100 mA	0·25
250 V	+40 db	25 MΩ	5 MΩ	25 mA	0·24
100 V		10 MΩ		5 mA	0·24
50 V	+26 db		1 MΩ	1 mA	0·24
25 V		2.5 MΩ			
10 V	+12 db³)	1 MΩ	200 kΩ	0·25 mA	0·24
2·5 V		250 kΩ		50 μA	0·2
0·5 V		50 kΩ		10 μA	0·1
100 mV		10 kΩ			

Resistance and Capacity Ranges		Voltage Source
Ω	0 to 200 Ω	In-built 1.5 V battery
kΩ	0 to 50 kΩ	
kΩ x 100	0 to 5 MΩ	
MΩ x 10—	0 to 500 MΩ	100 to 140 V DC
MΩ~	0 to 50 MΩ	100 to 240 V AC
μF x 0·1	0 to 5 μF	(45 to 65 c/s)

TECHNICAL DATA

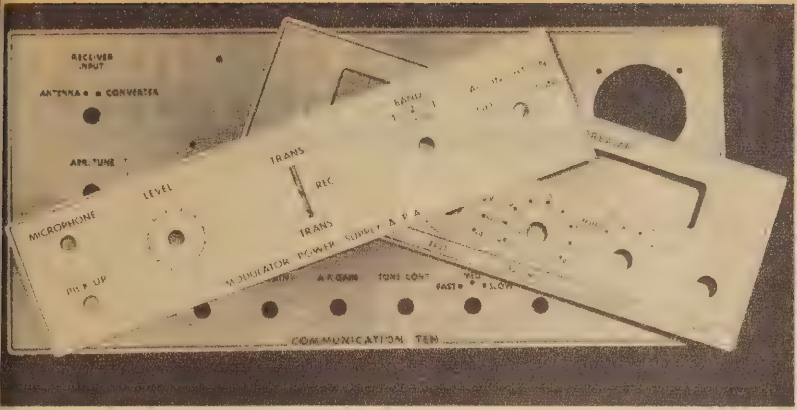
Indicating Accuracy:

On DC: ± 1.5% of full scale value.
On AC (50 to 60 c/s): ± 2.5% of f.s.d.
On 5,000 V DC: ± 5% of full scale value.

The CUT-OUT breaks the measuring circuit at more than 20 times overload. Switch rating max. 15kVA AC or 2kW DC (500V).

WATSON VICTOR LTD.

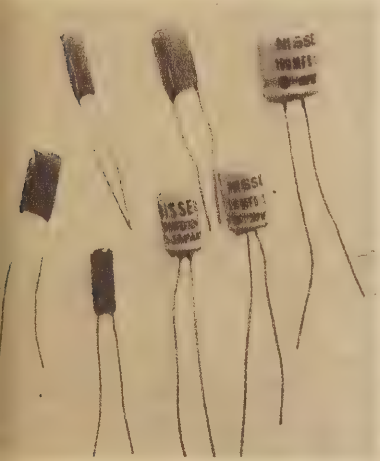
SYDNEY: 28 2851 • MELBOURNE: 41 4116
BRISBANE: 91 4441 • ADELAIDE: 23 2155
PERTH: 21 8021 • WELLINGTON: (N.Z.).



HEATING SYSTEMS PTY. LTD., of 24-32 O'Riordan Street, Alexandria, N.S.W., has available a wide selection of front panels for recent projects described in ELECTRONICS Australia. They are brushed aluminium finish with panel markings in appropriate colours. The panels illustrated here are for the combined modulator, power supply and P.A. amplifier (January, 1965, issue), the Amateur Band 10 receiver (May, 1965, issue) and the Playmaster 106 and 107 tuner/amplifiers (December, 1963, and March, 1964, issues).

umbered types, and temperature com-
ensated devices. Warburton Franki, as sole
ustralian agents for International Rectifier,
vill replace any zener diode of the com-
any's manufacture purchased on or after
ebruary 1, 1966, provided it proves to be
efective in workmanship. This guarantee
valid providing devices are used within
anufacturer's published ratings and in ac-
ordance with good engineering practices.
or further particulars, contact Warburton
ranki Ltd., at 307 Kent Street, Sydney.

HALLAM MAGNETICS PTY. LTD. is
newly established company which will
oncentrate on iron-clad components for
ommunications, instrumentation and indus-
ry. Governing director is C. G. (Bill)
allam, formerly managing director of Stabilac Pty. Ltd., and founder of National Transformers Pty. Ltd. Mr Hallam advises that the new company is already producing in premises located at 6 Grove Street, Dulwich Hill, N.S.W. (Phone 560-9412, 56-8017).

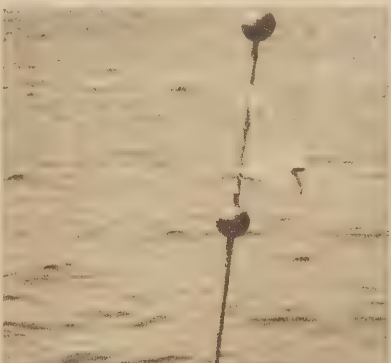


DEITRON ELECTRONICS recently submitted samples of Mylar capacitors and miniature electrolytic capacitors for our inspection. Manufactured by Nissei of Japan, these capacitors are ideal for use with printed wiring boards. We have used this brand of capacitor in some of our recent projects involving the use of printed wiring boards and have found them fully satisfactory in both electrical characteristics and physical dimensions. Inquiries regarding Nissei capacitors should be directed to Deitron Electronics, P.O. Box 86, Broadway, N.S.W.

EMERSON AND CUMING, INC., of Canton, Massachussetts, U.S.A. are the makers of the Omni-Azimuth Ecco Reflector (illustrated). This is a passive microwave reflector, visible from all sides and having an elevation viewing range sufficient for use in seaway channel marking, in air-to-sea search, and in small aircraft cross-section augmentation for air-traffic control.

Total elevation viewing angles greater or smaller than the nominal 25 to 30 degrees at the 3dB points are available. The range of elevation viewing angle can be centered away from the horizontal plane if desired, e.g., 0 to +30 degrees for sea search, +10 to —25 degrees for small-aircraft augmentation, 0 to —20 degrees for tower-mounted coastline passive beacons. The makers say that two reflectors spaced 6 to 8ft apart on a shaft 20ft above the water can be picked out by radar transmitted from a source less than 30ft above the water at distances up to 10 miles.

In the illustration, the reflectors are shown is use for marking a submerged instrument package used in the study of ocean currents.



Omni-Azimuth Ecco passive radar reflector.

BUSINESS SUCCESS IS WON BY NIGHT

In order to deal efficiently with the thousand and one problems which come his way in the course of a day, today's businessman has to be a practical psychologist, an expert at selecting, placing and motivating staff, a past master at writing action-getting letters and reports, a skilled negotiator able to communicate effectively with others. He must possess the ability to sell his ideas and himself, be a capable public speaker, an inspiring leader, a top-class manager and administrator. He must have a sound understanding of all the major profit-producing factors in business. He must be a creative thinker, a problem solver, able to conduct fruitful meetings. He must understand the problems related to advertising and public relations. In order to make fruitful decisions he must be acquainted with modern marketing methods, motivational sales management and dynamic retailing. He He must be equipped to draw a correct diagnosis from financial statements, and when credit is called for he must know the many avenues which are available today for raising capital in the financial world. He needs to have an understanding of economics, the stock exchange, investment matters, and must be equal to every social occasion and be able to play "the host with the most" when entertaining VIPs. A tall order if ever there was one but nevertheless imperative.

Since his days are devoted to "action", no wonder he appreciates a few quiet moments at night, browsing through a new publication designed to give him in a concise time saving form all he needs to know about business success and how to achieve it.

FREE! An informative 24 page booklet entitled "How to Succeed in a Man's World" outlines a practical plan to help you achieve greater business success. Limited printing. Send for your free copy.

MAIL THIS COUPON TODAY

To: MAN'S WORLD, 109 Sturt Street,
South Melbourne. Vic.

I wish to learn more about your publication and would appreciate a copy of your FREE 24-page booklet by return post.

NAME..........
(Please Print)

ADDRESS..........

..........STATE..........

OCCUPATION..........

E.3.66.

AMATEUR BAND NEWS AND NOTES

WICEN — Preparation For Emergency

Over the years amateur radio operators throughout the world have given valuable assistance to their communities during time of emergency. But much to their disappointment the voluntary service which the Australian amateurs offer to the community is not being fully exploited.

By Pierce Healy, VK2APQ*

The flexibility the Amateur Service has to offer in the field of communications during times of emergency is not known by the public in general.

While major disasters in various parts of the world and at home make headlines in the Press and at odd times mention is made of the work done by amateur radio groups or individuals, little news appears on the everyday type of service amateurs in Australia can provide.

The Wireless Institute of Australia has always had an emergency net organisation and its members have played important roles during periods when disastrous fires or floods have ravaged various areas in the Commonwealth.

It was during the years 1957-1959 that amateur operators were first invited to attend a Civil Defence School on communications, organised by the Commonwealth Government, at Mount Macedon in Victoria.

Although these schools dealt mainly with problems that might be encountered in providing communications during the disorganised conditions following an atomic attack on the major centres of population, the authorities were also alert to the problems associated with natural disasters caused by cyclones, floods or fires.

Amateurs also appreciated the problems in providing communication services in times of emergency and offered their services as an organised communications unit.

It was following these early schools at Mount Macedon that the title 'Wireless Institute Civil Emergency Net' (abbreviated to WICEN) was adopted and the facilities of the institute's organisation offered as a voluntary service to the various State authorities.

In some official quarters doubts were expressed as to the capabilities of such an organisation being able to discipline its members, and their ability to cope with service type traffic handling procedures, and although this was refuted very strongly by amateurs, it was very difficult to disprove.

The major obstacle to proving their capabilities by means of planned exercises, was the PMG regulations relating to the handling of third party traffic as applied to the Australian Amateur Service. However, exercises were held, without infringement of the regulations, and it was proved beyond doubt that the amateur operator interested in WICEN could, besides adapting disposals equipment for amateur use, easily cope with any type of message handling procedure.

On a few occasions in New South Wales, WICEN has taken part in official Civil Defence exercises, but much to the disappointment of the members, and those in other States, only in Victoria has WICEN been incorporated as part of the State overall emergency plan.

The first active WICEN organisation was formed in New South Wales and its activities were directed towards linking various areas within the State where the danger of flooding exists, with centres outside the isolated areas. Also, to provide when required, a communication link through the Division's station at Dural for the relay of traffic to the State Civil Defence organisation headquarters in Sydney.

Because of changing circumstances, during which PMG radio telephone links have been installed in areas where damage to telephone lines would have resulted in complete isolation and the fortunate absence of any widespread major disaster coupled with the lack of official recognition, there has been a slackening of interest in WICEN in New South Wales.

In the meantime, disastrous bush fires in parts of Victoria brought that State's WICEN organisation into operation, and, following several exercises, it has been accepted as a part of Victoria's overall 'Disaster Plan'. In Victoria, WICEN is a highly mobile VHF communication system with HF and VHF repeater links back to a localised base or Central Headquarters.

However, through the release of several types of two-way mobile radio units on the disposals market, a new look has been injected into the N.S.W. organisation. Over the past twelve months more than seventy of these units have been modified for use on the amateur bands and a highly mobile network of stations has been formed, operating in the Sydney, Newcastle, Canberra, Wollongong and Orange areas.

A recent practice exercise, with the object of determining the coverage obtainable from the Division's transmitting station VK2WI at Dural, was very successful. Mobile units following selected routes and reporting in from pre-determined points along each route provided comprehensive data on the strength of signals which can be expected from various areas. The area covered was from Broken Bay, north of Sydney, to Wollongong in the south and Mount Victoria in the west.

A permanent record in the form of a taped recording of the complete exercise was made at the base station VK2WI. This recording, together with the route maps showing reporting points, will be used to determine the location of repeater stations necessary to serve the areas of poor coverage from Dural. Consideration will be given to the possibility of using a station located at the home of a member or manning a portable station should the necessity arise.

Since the exercise, WICEN organisers have learnt that some authorities associated with emergency work following fires or floods in the areas covered by the exercise were unaware that such a voluntary organisation as WICEN existed and were appreciative of the possible assistance available in an emergency.

To enable a number of nets to operat within a given area without interferenc to each other, a table of operating frequencies has been drawn up. The units use are crystal-locked, with the transmitter an receiver operation on the same frequency Frequencies to be used in the two and six metre amateur bands are:

Two-metre band, using frequency modulation plus or minus 15KC deviation
Channel A 145.854MC
Channel B 146.000MC
Channel C 146.100MC

Six-metre band, using frequency modulation plus or minus 15KC deviation
Channel A 53.920MC
Channel B 53.950MC

Six-metre band, using amplitude modulatio
Channel 1 53.786MC
Channel 2 53.826MC
Channel 3 53.866MC

Channels A and B in the two-metre ban correspond with the frequencies used i Victoria but the six-metre frequencies diffe from other States due to the different type of TVI problems encountered. Channel 146.000MC in the two-metre band is th prime mobile frequency, with Channels and C as secondary frequencies for us when necessary.

Channel B 53.950MC in the six-metr band is the prime frequency using the F mode. Base stations for both modes wi be installed at VK2WI. All six-metre frequencies are intended to be used as link between various control points. Over 5 of the stations now operating in the ne are in the Sydney and reasonably clos surrounding districts, eight are operating i Orange, six in Newcastle and three i Canberra.

In the Newcastle area a base station ha been established at the Westlakes Radi Club at Teralba and operates under th call sign of the Hunter Branch, VK2AW Reports on tests carried out indicate tha strong signals are generally heard fro most areas on the western side of the cit of Newcastle, while several Sydney statio including VK2WI, have been heard.

Tests conducted at Orange with the bas station located at Mount Canobolas hav resulted in excellent signals being exchange with Sydney, Mount Ginini near Canberr Blackheath, Wellington and many surroun ing towns. Mobile-to-mobile contacts hav been made with absolutely reliable signa within a radius in excess of 10 miles fro Orange township.

VICTORIA

Early in January a serious bush fire brok out in Victoria and on January 1 a request for assistance from the Victoria Wireless Institute Civil Emergency Netwo was received from the PMG Divisiona Engineer at Ballarat.

It was requested that WICEN provi mobile communications in an area sout of Enfield for fire-spotting duties aroun the perimeters of forest fires that had bee burning for several days.

The following day had been declare a day of total fire ban, high winds and strengthening north-easterly wind had bee predicted. The request was acceded to an at 5.30 a.m. on Wednesday morning convoy of 12 vehicles left Melbourne f the Country Fire Authority's sector Hea quarters in the fire area.

A control station under the call sig VK3EM, established at Mount Buninyo with automatic VHF repeater facilities fro VK3ZPB, had direct contact with VK3W the Victorian Division's official station Melbourne. A base station was establishe and operated under the call sign VK3AF and some traffic was handled f

---

*News and notes of Divisional and Club activities, submitted for inclusion in these columns, should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.

; Country Fire Authority. However at out 3.15 p.m. a strong south-westerly ange in the weather brought heavy rain iich effectively doused the fires and ieved the situation.

The unexpected change in the weather abled the operators concerned to return Melbourne the same evening. Altogether, operators were involved during the day. ie officers of the Country Fire Authority ve expressed their appreciation for the sistance rendered.

The WICEN co-ordinators feel there are number of interested persons who re-ained from joining the organisation cause of the lack of mobile equipment. is stressed that there is always the need r assistants as operators and for other sociated duties during times of emergency.

SOUTH AUSTRALIA

The WICEN Co-ordinator for the South istralian Division reports that the replies ceived to the questionnaire sent out in ecember were very satisfactory. A roster r stations in the WICEN net has been awn up for a period of three months d will be published in the Institute Jour-l and broadcast over VK5WI each week. ise station frequency is 53.1MC and stat-is using variable frequency oscillators are quested to net carefully on this frequency.

Base station call signs are VK5EK and K5KF north of Adelaide with VK5MM d VK5TY in the south. Geoff Taylor, K5TY, WICEN co-ordinator, will be eased to hear from those interested in king an active part in the organisation.

The radio amateur has often been refer-l to as a strange type of individual who iys up all night, listening and talking all rts of strange jargon. This may appear so the uninformed, but the radio amateur ay be a fairy godmother in times of iergency and should be accepted as a per-n with ability that could be of great sistance to the community in an emerg-cy. Amateurs who are interested in offer-g a service to the community are invited contact the WICEN co-ordinators in their ate.

Organisations or persons wishing to ob-n information on the Wireless Institute vil Emergency Net in their State may do from the following postal addresses:-

N.S.W.—Wireless Institute Centre, 14 chison Street, Crow's Nest.

Victoria—W.I.A., Victorian Division, P.O. ox 36, East Melbourne, C2.

South Australia—W.I.A., South Australian ivision, Box 1234K, G.P.O., Adelaide.

Queensland.—W.I.A., Queensland Divis-n, Box 638J, G.P.O., Brisbane.

Western Australia.—W.I.A., Western Aus-lian Division, Box N1002, G.P.O., Perth.

Tasmania.—W.I.A., Tasmanian Division, ox 851J, G.P.O., Hobart.

Federal Executive.—W.I.A., Box 2611W, P.O., Melbourne.

W.I.A. Activities

An invitation has been extended to the ireless Institute of Australia by the Inter-tional Amateur Radio Union, to attend Regional Conference to be held at the otel Kvarner, Opatija, Yugoslavia, from ay 23rd to May 26th, 1966.

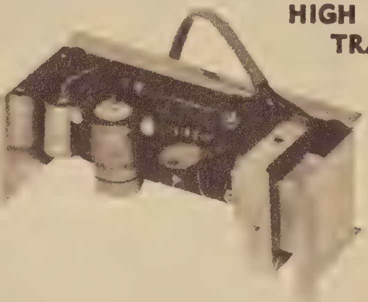
Although it is most desirable that a legate attend, finance is the limiting fac-r and on this score the invitation was very gretfully declined. However, there may be Australian amateur with some back-ound on Wireless Institute affairs and the nateur Service in Australia holidaying or business in Europe during the period of conference, who will have time to at-id and represent the W.I.A.

Federal Executive would like to hear om someone who will be in the position attend the conference and address that dy on behalf of us all in Australia.

AUSTRAL RADIO PARTS SERVICE

21 DICKSON AVENUE, ARTARMON, N.S.W.
43 3556 43 3556

HIGH QUALITY PRE-ASSEMBLED TRANSISTOR AMPLIFIERS



Power output 3.6W sensitivity 5 millivolts.
Input impedance 800 ohms.
Load impedance 15 ohms.
Freq. response 90cps to 15Kcs.
Distortion total harmonic 1.3% at 2.4W.
Supply 12-14.5V at 600mA.
Size 4¼ x 1¾ x 1¾in. Add 3/6 for packing and post.

Price £7 ($14.00) inc. tax.
Fully Guaranteed.

MINIATURE ELECTROLYTICS

Capacity	Volts Wkg.	Price	
5MFD	6	2/6	$0.25
10MFD	10	2/6	$0.25
100MFD	10	3/6	$0.35
200MFD	10	4/6	$0.45
640MFD	16	9/	$0.90

inc. tax.

Lots 10 or more less 10%. Please add postage.

MINIATURE 2 GANG IMPORTED TUNING CONDENSER

Self tracking osc. section 6.9—90Pf aerial section. 8-200pf comes complete with trimmers and all States circular dial scale. Only **15/, $1.50** inc. tax. Size 1⅜in x 1⅜in x ¾in.

Add 2/- for packing and post.

Miniature 4 coil press button tuner for transistor radios

Self tracking osc. section provision for aerial, band pass and RF stage come complete with drive and shaft and spec. sheet. **£5/10/, $11.00** inc. tax.

Add 4/ packing and post.

CAR AERIALS

Miniature 6 piece 6in to 32in, suit VHF or port, **15/, $1.50.**

3-piece topcowl with 5ft lead and benj plug. **£2/10/, $5.00.**

5-piece lockdown with 4ft lead and benj plug. **£4, $8.00.**

Above price inc. Tax. Add 5/6 for packing and post.

Transistors at special prices

2N301	22/6	$2.25
2N406	9/6	$0.95
2N408	9/6	$0.95
2N410	9/6	$0.95
2N412	9/6	$0.95
2N591	10/	$1.00
2N1637	9/6	$0.95
2N1638	9/6	$0:95
1N87A	3/6	$0.35
2N1639	9/6	$0.95
1N3193	7/6	$0.75
OA90	3/6	$0.35
0A91	3/6	$0.35
OA210	9/6	$0.95

New valves in sealed cartons Fully Guaranteed

1B3GT	17/6	$1.75	6ES7	17/6	$1.75
152	17/6	$1.75	6SJ7	25/6	$2.56
5AS4	16/	$1.60	6SK7	32/6	$3.25
5Y36	14/	$1.40	6SN76TA	17/6	$1.75
6AQ5	16/	$1.60	6V66T	19/	$1.90
6AU46T/A	17/6	$1.75	644	11/	$1.10
6AV6	13/6	$1.35	12AQ5	16/6	$1.65
6BA6	16/	$1.60	12AU6	16/6	$1.65
6BEG	16/	$1.60	12AV6	15/6	$1.55
6BM8	18/	$1.80	12BA6	16/6	$1.65
66Q7A	17/6	$1.75	12BE6	19/6	$1.95
6CM7	17/	$1.70	12BH7A	17/	$1.70
6CQ8	17/6	$1.75	12BQ6GTB	33/6	$3.35
6DQ6	24/6	$2.45	12DQ6A	33/6	$3.35
6EH7	17/6	$1.75			

Please add postage.

SORRY NO C.O.D.

Should someone be in this fortunate positio
and would like to attend, they are invite
to write to Federal Executive, Box 2611V
G.P.O., Melbourne, Victoria for the nece
sary letters of introduction to be given.

Members are reminded that the Feder
Convention commences in Brisbane o
Good Friday, April 8th. Items considere
to be of sufficient importance to warra
discussion by delegates from all Divisio
should be sent to Divisional Secretari
without delay. While these items may b
received too late for inclusion
the Agenda, they may be raised under th
heading of General Business.

NEW SOUTH WALES

As is usual each year, the Australia Da
weekend is a period of high activity in th
New South Wales Division. The Divisiona
Convention commenced with the Gener
Meeting at Wireless Institute Centre on Fr
day evening, January 28th. Over 100 mem
bers in attendance heard a series of ver
interesting lecturettes accompanied by
demonstration of the equipment described.

The first lecture was given by Davi
MacNaughton, VK2ZVW, on the "Mob
leer Project," a 144MC transmitter an
receiver. The unit on display was an exce
lent piece of home-built equipment, th
outcome of a concentrated effort by mem
bers of the VHF and TV group committe
to design an efficient piece of VHF mobil
equipment.

The second was given by Leo McMahon
VK2AC, who introduced his subject a
"A report to the nation on the curren
state of the art of CW." The unit on dis
play was an electronic keyer and a serie
of comparisons was made between th
"swing-along" type of morse produced b
the users of the "village pump" and th
more sophisticated code produced by any
one using an electronic keyer. A tap
recording of the various types and speed
left no doubts as to the advantages o
such a device to operators using mors
code.

Stan Bourke, VK2EL, then displayed
"home brew" copy of the Swan single side
band transceiver. Stan used the commercia
unit to illustrate how he had overcom
some of the constructional problems h
encountered and the use he made of com
ponents obtained from disposal items. Thi
was another piece of well constructed home
built equipment.

A display of amateur television equipmen
was given by Bill Dockerill, VK2ZDO
Bill briefly covered the fundamental point
relating to the production and the use o
the different sync pulses, the vidicon tube
the function of the different elements an
the information obtained from a test car
pattern. A complete closed-circuit systen
in operation was used for the demonstration

The final lecture was given by Barr
Gerdes VK2ZAH, who spoke on frequenc
modulation and the use being made o
FM VHF units that had become availabl
through disposal sources. On display wa
one of the disposal units and Barry gav
a short resume of the modifications neces
sary to make the unit suitable for use o
the 146MC FM net. He also gave som
details of a FM-AM crystal-switched trans
mitter and receiver he had constructed
which was also on display.

Interspersed with the lectures was
number of presentations. The award for th
best lecture of the year was made t
Allan Morris, for his excellent lecture o
Magnetic Amplifiers. The "Adams Trophy
was awarded to Roy Lester VK2ZRL, fo
the best article by a N.S.W. member, pub
lished in the institute magazine, "Amateu
Radio." The article was entitled "Two Ban
VHF Converter." The "John Moyle Memo
rial Prize" for the student who gained th
highest marks in the Divisions' A.O.C.P
classes during the year was presented t
Ron Glover.

The President of the Division, Ivan Agar
VK2AIM, accepted on behalf of member
the "Jim and Ruth Corbin Memoria
Shield." The trophy was a donation by

JABEL **DIALS, DRIVES and COUPLINGS**

1 **JB6/1**—4½in x 3in Instrument Dial. A 6 to 1 reduction drive with cursor, perspex panel, calibrated log scale and knob, on metal backplate **$3.60**
JB6/36—As above, but with dual ratio drive—6 to 1 plus 36 to 1 reverse vernier **$5.00**
2 **JB461**—4in dia. calibrated aluminium disc with inbuilt 6 to 1 ratio reduction drive, complete with panel cursor **$4.50**
3 **HSK**—3in Handspan Dial Kit, with Australian stations scale and matching volume control knob **$1.00**
HSKV—As above, but with inbuilt 6 to 1 reduction drive **$2.80**
4 **HSO**—Plain Handspan Disc only, with attached knob (Philips W.B. Tuner, G.D.O., etc.) **75c**
5 **C36**—8 to 1 reduction instrument dial, calibrated 0-10, 36 mm. dia. **$1.50**
C50—As above, 0-100, 50 mm. dia. **$1.80**
C70—As above, 0-100, 70 mm. dia. **$2.40**
6 **No. 1**—6 to 1 ratio Planetary Drive ¼in to ¼in **80c**
No. 2—as above, but with cursor flange and cursor **$1.20**
No. 3—As above, but dual ratio—6 to 1 plus 36 to 1 reverse vernier. Complete with cursor flange and cursor **$3.00**
7 **Flexible Coupling**, fully insulated, polythene membrane ¼in to ¼in; also available ¼in to 3-8in and 3-8in to 3-8in .. **70c**
8 **Rigid Couplings:** ¼in to ¼in Brass . **25c**
¼in to 3-8in, 3-8in to 3-8in Brass, and ¼in to ¼in insulated **30c**

All prices plus Sales Tax: 25 p.c. on HSK HSKV HSO and Flexible Couplings—all others 12½ p.c.

AVAILABLE FROM RADIO SUPPLY STORES EVERYWHERE

WATKIN WYNNE PTY. LTD. 32 Falcon St., Crow's Nest (P.O. Box 318).
Phones: 43-2107, 43-1912.

BRIGHT STAR CRYSTALS

FOR ACCURACY, STABILITY, ACTIVITY AND OUTPUT

Our crystals cover all types and frequencies in common use and include overtone plated and vacuum mounted. Holders include the following: DC11., F.T. 243., H.C.—6U., CRA., B7G., OCTAL, HC-18U.

5.5 5.5MC TV Sweep Generator Crystals.
£3/12/6 ($7.25) plus 12½ p.c. sales tax
100 KCS and 1000 KCS. Frequencies Standard.
Crystals £8/10/- ($17.00) each plus 12½ p.c. sales tax.

AUDIO ULTRASONIC AND SPECIAL CRYSTALS
PRICES ON APPLICATION.

The following fishing craft frequencies are available in F.T. 243 holders:
6280, 4095, 4535, 2760, 2524, 2182, 4620, etc.
Immediate delivery available for all above types.

AMATEUR TYPE CRYSTAL 3.5 and 7 MC BAND
Commercials — from £3/12/6 ($7.25) each plus 12½ per cent sales tax.
Amateur — from £3/-/- ($6.00) each plus 12½ per cent sales tax.
Regrinds 37/6 ($3.75) each

Crystals for Taxi and Bush Fire Sets also Available.
We would be very happy to advise and quote.

Representatives Aust. and New Zealand—Messrs. Carrel & Carrel, Box 2102, Auckland

Messrs Atkins (W.A.) Ltd.,
894 Hay St., PERTH.

Messrs. A. E. Harrold Pty. Ltd.
123-125 Charlotte St.,
BRISBANE

Messrs. United Radio Distributors Pty. Ltd.,
175 Phillip St., SYDNEY.

Messrs Lawrence and Hanson Electrical (Vic.) Pty. Ltd.,
56 Collins St., HOBART and
29 St. John St., LAUNCESTON
Tasmania.

"Contractors to Federal and State Government Departments."

BRIGHT STAR RADIO
46 Eastgate St., Oakleigh, S.E. 12, Vic. 57-6387
WITH THE CO-OPERATION OF OUR OVERSEAS ASSOCIATES OUR CRYSTAL MANUFACTURING METHODS ARE THE LATEST.

ne late Jim Corbin VK2YC and his wife, ade with the object of encouraging parti- ipation by members of the N.S.W. Division, the Remembrance Day Contest. Bill ewis VK2YB, a member of the com- ittee which was given the task of im- lementing the objects envisaged by the onors, handed over the trophy, which will e hung in the meeting hall of the Wire- ss Institute Centre.

In the business session of the meeting, the ederal Councillor, Pierce Healy, VK2APQ, resented his report on the activities as- ociated with the Federal aspect of In- itute affairs during 1965. The report dealt ith the work of the Federal Executive nd Federal Contest Committee, the im- act that certain matters dealt with during 965 will have on the future of Amateur adio in Australia, the I.T.U. and the eed for closer ties with member societies Region 3. The report will be published full in the Divisional Bulletin.

Following the acceptance of the report nd an expression of thanks from the resident and members for the work done behalf of the Division, nominations ere called for the position as Federal ouncillor for 1966. The only nomination ade was for the retiring Federal coun- llor, Pierce Healy, VK2APQ, who was us re-elected unopposed. Keith Howard K2AKX was nominated as observer r the Federal Convention in Brisbane nd received unanimous approval from the eeting.

The Convention dinner was held on turday evening, January 30, at the Wire- ss Institute Centre when members, their ves and visitors, in all totalling more an 70, enjoyed a very pleasant evening. ne Toast "Amateur Radio and the Wire- ss Institute" was proposed by Morrie eyers VK2VN and the President of the ew South Wales Division, Ivan Agar K2AIM, responded. The Toast to the isitors was proposed by Pierce Healy, K2APQ. Among the visitors present was r R. Holt of the PMG Radio Branch d Frank Noel K6EDQ, and his wife. ne response on behalf of the visitors was ade by Frank Noel, who related some the highlights of the trip he and Mrs oel had made around Europe, including eetings with members of the I.T.U. Radio ub in Geneva.

Following the dinner two impromptu dis- ssions took place that created quite a al of amusement. The first was entitled Iome Construction Versus Commercial quipment" and the second between teams ach with a lady member) entitled "Ama- ur Radio Versus Gardening."

The Field Day at the Division's trans- tting station, Dural, saw a gathering of ore than 200 enjoying the pleasure of newing old friendships and participating the various field events.

The results of the field events were:—

MOBILE SCRAMBLE

VHF Section

Dick Norman, VK2ZCF, 1st; Stephen ahl, VK2ZSK, 2nd; Dave Andrews, K2AWZ, 3rd.

HF Section

Harold Burtoft, VK2AAH, 1st; John rk, VK2ALK, 2nd; Lindsay Douglas, K2ON, 3rd.

RST 144MC HIDDEN TRANSMITTER HUNT:—

Allan Williams, VK2ZAL, 1st; Paul Jack- n, VK2ZPJ, 2nd; Harold Burtoft, K2AAH, 3rd.

SECOND 144MC HIDDEN TRANSMITTER HUNT:—

Lindsay Douglas, VK2ON, 1st; Ron yle, Assoc., 2nd; David Priestley, Assoc., l.

The winners of the two 144MC Hidden ansmitter Hunts for Pedestrians were;— vid Priestley, Assoc., and Ian Mackenzie, K2ZIM.

The 7MC Transmitter Hunt was won by Dave Andrews, VK2AWZ. In addition there were novelty events for the ladies, including nail driving, throwing the rolling-pin and balloon bursting. A hoop-la stall also enticed many to try their skill.

The display and demonstration of commercial single side-band equipment by Ron Richardson, VK2ALR, was most interesting and appreciated.

The day concluded with the presentation by the president, Ivan Agar, VK2AIM, of an excellent assortment of prizes donated by Telecomponents Pty. Ltd., Electronic Parts Pty. Ltd., Morganite Aust. Pty. Ltd., O. T. Lempriere and Co. Pty. Ltd., and other trade houses.

HUNTER BRANCH

Two members of the Hunter Branch, Henry Schroeder, VK22GK and Bob Blyth, VK2BOB, who recently received their call signs, made good use of the holiday period to get their stations on the air. Both are members of the Westlake Radio Club, where they received much of their instruction in theory.

Two other members, Col Johnston, VK2YJ, and Les Baber, VK2RJ, have made equipment changes and both are putting out very strong single side-band signals on the HF bands. Col, in conjunction with Bill Hall, VK2XT, who is the local authority on whip aerials, has produced a new trap dipole suitable for multi-band operation.

Congratulations are in order for Ian Forrest, VK2AJF, who has been notified of his success in the examination for Broadcast Operator's Certificate of Proficiency. Ian first gained high esteem by being the first schoolboy in Australia to be awarded an amateur transmitting licence, gained while he was a pupil of Booragul High School. Since leaving school he has worked as a technician with Chris Cowan, VK2PZ, at Cessnock. Ian hopes later to travel overseas to further his studies. Another of Chris's employees, Peter Parry, VK2AIY, recently left for Great Britain where he is making tourism and work combine in an overseas holiday.

Michael Latham, another member of the Westlakes Radio Club, has been notified of his call sign, VK2ZLE. Michael hopes to be operating on two metres in the near future.

The next meeting of the Hunter Branch will be held at the Technical College, Tighes Hill, on Friday, April 1. Details of room arrangements and lecture for the evening will be given in the weekly broadcasts from VK2AWX, which may be heard each Monday at 7 p.m., on 3595KC and relayed by VK2ZSG on 144MC.

CENTRAL COAST BRANCH

Two more students (Terry Crews and Michael Korsch) of the Gosford Radio Club's A.O.C.P. class conducted by John Derring, VK2ND, have passed the P.M.G. examination and are awaiting their call signs. Paul Goldsbrough, VK2AVX, another club member, has won a Teacher's Scholarship to study for his B.Sc. at the Newcastle University.

YL NEWS

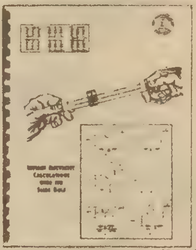
ABC TV Channel 2 Weekend Magazine, in a program on the Antarctic, on Sunday, January 30, featured Mrs Hebe Grouse, VK2AOK, conducting a QSO with members of the Antarctic Base at Mawson.

Mrs Mavis Stafford, VK3KS, of Melbourne, has become the sixth to gain the WPX award on CW.

QUEENSLAND

The Council of the Queensland Division extends an invitation to any member of the Institute who may be in Brisbane during the Easter holidays to attend some of the activities associated with the 1966 Federal Convention. Full particulars can be obtained from the Secretary, W.I.A., Queensland Division, Box 638J, G.P.O., Brisbane.

Save Hours Weekly with this exciting New Electronic Slide Rule and Instruction Course



Beginners and Experts easily beat conventional slide rule users with this new rule and its five times faster methods. You combine ALL the latest scales to work this Magic.

Specially selected Slide Rule and eight lessons Electronics Course designed to solve your problems quickly . . . accurately. No need for a library of design data. No need to spend hours searching through ● Tables and graphs . . . ● Text books . . . ● Magazines . . . ● Manufacturers' data . . . when you can calculate component values instantly. You can redesign and adapt overseas circuits to the parts you have or can quickly obtain.

This special Slide Rule is a silky-smooth, seasoned 10in instrument that can be used for conventional calculations too. Specially designed for electronics work it has special scales for ● Decibels . . . Inductance . . . ● Nepers . . . ● Capacitance . . . ● Powers . . . ● Vectors . . . ● Surge Impedance . . . ● Frequency/Wavelength . . .

An eight lesson electronic instruction course comes with each rule . . . includes clear diagrams and step-by-step explanations to make learning fast, easy. Several hundred practice problems deal with widely occurring situations in electronics . . . teaches many special short cuts . . . lists the best setting for solving complex problems. Gives you extra time . . . for your family . . . for new projects WITH THE TIME YOU SAVE using this new Slide Rule and eight lesson electronics course . . . all yours for just $29.95 (£14/19/6) — fill in coupon or write now.

SEND COUPON TODAY!

to Top Management Services, 69a Church Street, Brighton S.5, Vic. Phone 92-3158.

☐ Please send me your Electronics Slide Rule with 8 lesson Electronics Course.

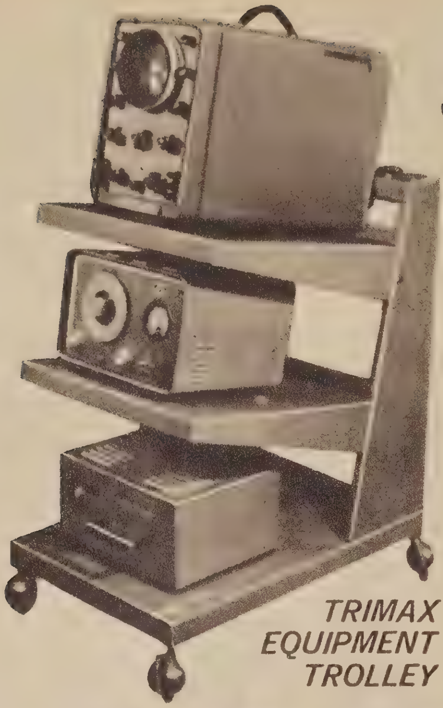
I am enclosing $29.95 (£14/19/6).

☐ Please send descriptive literature only. without obligation.

NAME ....

ADDRESS ....

.... 3/66



TRIMAX
EQUIPMENT
TROLLEY

SMOOTHEST MOVEMENT

brings Australia-wide acceptance!

Success shown by Australia-wide sales of the Trimax Laboratory Equipment Trolley is due to functional design, use of high quality rubber tyred swivelling castors, and finest workmanship.

Fitted (as illustrated), the unit is ideal for moving heavy electronic test equipment. By inverting the shelves, the unit becomes an ideal mobile production trolley with deep, easily accessible trays.

Made in standard order, the Trolley is finished in grey hammertone metal. Available with or without three mains outlet sockets which allows mains-operated equipment to be supplied by one extension lead.

Trolley supplied in easy-to-assemble knock-down form for economic transport.

L M ERICSSON PTY. LTD.
"TRIMAX" DIVISION
FACTORY: CNR. WILLIAMS RD. & CHARLES ST., NORTH COBURG, VICTORIA. 'PHONE: 35-1203 . . . TELEGRAPHIC ADDRESS: "TRIMAX" MELB.

L37/

★ CONVOY

SPECIALS

CONVOY STEREOTONE COMBINATIONS From $199

Convoy 1 Watt

HIGH POWER TRANSCEIVER

Full 1 watt.
Leather over metal case.
13 Transistors (Silicon mesa type).
Fully P.M.G. approved.
External 12v Bat. plug.
Battery meter.
Sep. Squelch Control.
Earphone and carry strap.
Weight: 1¾lb.

$116.00

On approved list with Chief Secretaries Department for use by bush fire fighting organisations.

TAPE SPECIAL

Test your tape recorder. Now the new test tape for all enthusiasts, 3¾ and 7½ I.P.S. Post Free, $8.00.

Dual Player — Stereo Amplifier
Twin Speakers — Modular Cabinet

CHOOSE FROM:

	DUALS FULL RANGE SHURE CARTRIDGES
AMPLIFIERS	LEAK, STAR, MONARCH, PEAK SANSUI, ROLAND
SPEAKERS	GOODMANS, PEAK, WHARFEDALE, PEERLESS, AKAI

We can tailor a system to suit your taste and pocket. No messy wiring or huge speaker boxes necessary.

ORDER NOW FOR EARLY DELIVERY
TRADE ENQUIRIES WELCOME

TAPE RECORDERS
AKAI, SONY, TOYO, TANDBERG, MERIT, AIWA, PHILLIPS.
We also rent machines.

CONVOY INTERNATIONAL

449 KENT STREET, SYDNEY
Telephone 29-6475

SEE US ANY TIME FOR THE KEENEST QUOTE ON YOUR REQUIREMENTS

144MC DX OPENINGS

A list of New Zealand and Australian tations who made contact across the Tasnan on 144MC from late November, 1965, early January, 1966, compiled by Mac, L3RK, has been received from Tim Mills, 'K2ZTM, and is given below.

It is possible that the list is incomplete; this assumption is correct, details of ontacts not listed will be welcome so that ne record of this outstanding 144MC band pening will be complete.

Where quoted the approximate Greenwich lean Time is shown.

November 27:

0750	ZL3GE—VK2ZEK

December 8:

0650	ZL3AR—VK2TR
0725	ZL3AR—VK2HE
0722	ZL3TAT—VK2TR
0647	ZL3AAU—VK2TR
0740	ZL3AAU—VK2ZDD
0705	ZL3AAD—VK2HE
0725	ZL3AAD—VK2TR
0737	ZL3AAD—VK2ZDD
0720	ZL3IQ—VK2ZDD
——	ZL3GE—VK2DS
——	ZL3GE—VK2ZCF
——	ZL3UM—VK2TR
0715	ZL3RK—VK2HE

Also reported that ZL2CD and ZL3AQ orked VK2s.

December 9:

0735	ZL4OX—VK2ZBJ
0745	ZL4OX—VK2ZDP
0800	ZL4OX—VK2ZKP
0843	ZL3AAD—VK5BC
0715	ZL2HP—VK3ZAA
——	ZL2HP—VK2ZCF
——	ZL2HP—VK2ZCW
0800	ZL2HP—VK2ZBJ
——	ZL2AAH—VK2ZVW
——	ZL2AAH—VK2ZKP
——	ZL2AAH—VK3ZAA
——	ZL2AAH—VK2ZVL
——	ZL2AAH—VK2ZCF
——	ZL2AJB—VK3ZAA
——	ZL2AZL—VK2ZCF

Also reported: ZL2AZJ and ZL2TCW orked VK—.

December 13:

0750	ZL4OX—VK2TR
——	ZL4KU—VK2TR
0750	ZL3AR—VK7ZAP
0755	ZL3TAT—VK7ZAP
0825	ZL3TAT—VK3ZCR
0734	ZL3AAU—VK5ZKR
0812	ZL3AAU—VK7ZAP
0956	ZL3AAD—VK2ZEV
1000	ZL3AAD—VK2AXB
1007	ZL3AAD—VK2ZVL
——	ZL3UM—VK7ZAP
0800	ZL2HP—VK3ZNC
1007	ZL3NH—VK2AXB

December 15:

0735	ZL4OX—VK2AAK
0750	ZL4OX—VK3NR
0708	ZL3AR—VK2HE
0717	ZL3AR—VK2ZML
0725	ZL3AR—VK2BCF
0748	ZL3AR—VK2DS
0755	ZL3AR—VK2ZVW
——	ZL3GE—VK2ZDP
0755	ZL3VP—VK2ZIW
0755	ZL3TAT—VK2BCF
——	ZL3TAT—VK2ZCF
0746	ZL3TAT—VK2ZVW
0750	ZL3TAT—VK2ZVL
0755	ZL3TAT—VK2ZRU
0810	ZL3TAT—VK2HE
0733	ZL3AAU—VK2ZML
0740	ZL3AAU—VK2ZVW
0716	ZL3AAD—VK2HE
0723	ZL3AAD—VK2ZVL
0730	ZL3AAD—VK2AAK
0738	ZL3AAD—VK2ZCK
0741	ZL3AAD—VK2ZVW
0744	ZL3AAD—VK2ZIW
0753	ZL3AAD—VK2BCF
0746	ZL3AAD—VK2ZCF
0800	ZL3AAD—VK2ZML
——	ZL3AQ—VK2AAK

Also reported that 0908GMT VK5ZKR rd ZL3AQ.

December 23:

0815	ZL3TAT—VK2ZVW
0957	ZL4PG—VK2ZVW
0807	ZL4LV—VK2ZVW
0800	ZL3AAD—VK2ZBD
——	ZL3AAD—VK2ATO
——	ZL3AAD—VK2ZVW
0830	ZL3AAD—VK2HE

Also reported that VK5BC worked ZL2s.

January 2:

Reported that ZL1TCN worked two VK—

0355 ZL2TCW heard VK2ZCF.

SHORT WAVE LISTENING

Over the past weeks several letters have been received telling of the writers' interest and seeking information on short wave listening. The replies to these letters, it is hoped, have enabled those interested to get started in this fascinating aspect of amateur radio.

For those who are contemplating joining the world-wide band of short wave listeners, the following notes have been supplied by the President of the New South Wales S.W.L. Group.

"SWL-ing brings you into the magic circle of radio. It brings the world into your living room and opens up the way for undreamt friendships with peoples in other lands.

"Instead of living only in the country of your birth you now live in many lands, because your horizons have broadened and your interest has widened to include many nations and many people. You find you have become one of a great brotherhood, regardless of race, colour or creed.

"A member of the SWL group need never be bored or lonely, always there is something to hold the interest. In fact, within the confines of your small radio is held the entire world.

"If any person wants information regarding the SWL group or technical data, please write to the Publicity Officer, C. Aberneathy, 30 Urunga Parade, Miranda, N.S.W., or to the President, R. L. Erwin, P.O. Box 11, Carlingford, N.S.W. and we will be only too happy to oblige you with all the information you need.

"The S.W.L. Group General Meeting is held at the Wireless Institute Centre, 14 Atcheson Street, Crow's Nest, on the third Friday of each month, commencing at 7.30 p.m. Lectures are given and discussions held on Shortwave DX'ing, aerials and different phases of radio work."

Officers of the N.S.W. group are:—

President Ross L. Erwin WIA-L2233, P.O. Box 11, Carlingford, N.S.W.
Vice-President Bill Goodfellow WIA-L2030, 381 Balmain Road, Leichhardt, N.S.W.
Secretary-Treasurer Chris Middleton-Williams WIA-L2019, 3 Veronica Street, Chester Hill, N.S.W.
Publicity Officer Chas Aberneathy WIA-L2211, 30 Urunga Parade, Miranda, N.S.W.

RECIPROCAL LICENSING

Last month we gave news of Dave Medley, who operates on 14MC under the call sign VK3DL/W5. A further note from Dave tells of Dave Robertson, VK5RN/W2, who is active on both 20 and 40 metre bands. To date no information has come to hand of any U.S.A. amateurs who have obtained reciprocal licensing permits in Australia.

LEARN MORSE CODE

Use is certainly being made of the New South Wales Division's Morse tape service as evidence by a recent report from the supervisor, indicating that over 1,000 hours' playing time had been sent to interested parties.

Tapes have been sent to every State in Australia, the islands up north, and New Zealand.

The tapes have Morse code recorded at speeds from 5 words per minute to 20wpm, two hours on each reel. For example, No. 1 tape has one hour at 5wpm on one track and one hour at 6wpm on the other.

Recordings have been made at 3¾ inches per second, but other speeds can be supplied if necessary.

To obtain the loan of any of these tapes it is only necessary to write to the Education Officer, Wireless Institute Centre, Crow's Nest, New South Wales, requesting the Morse speed required.

The service is free—free to anyone, whether a member of the Wireless Institute or not, the only expense being 1/6 per tape to cover out-of-pocket expenses. Postage stamps, one eight-penny and two five-penny, will cover ordinary post within Australia.

CRYSTAL PYE DIVISION

Manufacturers of Quartz Crystals for Frequency Control and Crystal Filters for Highly Selective Circuits, Announce:—

NEW LOWER PRICES FOR CLOSE TOLERANCE GOLD PLATED CRYSTALS FOR AMATEUR APPLICATIONS

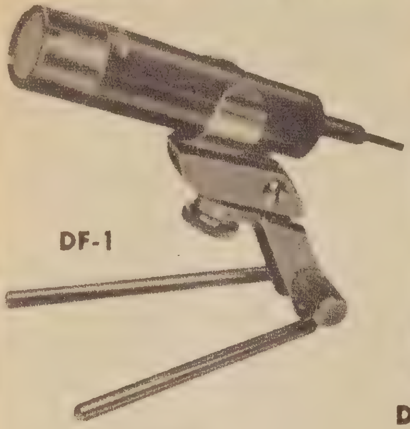
- 1.8 Mc/s to 14.999 Mc/s ± 0.005% in Style "D" holders, ½in pin spacing. **Amateur net £2/8/6 each including tax.**
- 15 Mc/s to 47.999 Mc/s ± 0.005% in Style "D" holders, ½in pin spacing. **Amateur net £2/10/6 each including tax.**
- 48.0 Mc/s to 61.0 Mc/s ± 0.005% in Style "D" holders, ½in pin spacing. **Amateur net £2/16/3 each including tax.**
- 100 Kc/s ± 0.005% in HC13/U holders, ¼in pin spacing* **Amateur net £4/10- each including tax.**
- 1 Mc/s ±0.005% in Style "D" holders, ¼in pin spacings* **Amateur net £4/10/- each including tax.**
- 455 Kc/s nominal Crystals for Filter applications in Style "D" or "E" (B7G) holders. **Amateur net £4/10/- each including tax.**

* Specially designed for Crystal Calibrator purposes.

Many other types and tolerances are available from our standard production. Please consult us on your Crystal requirements.

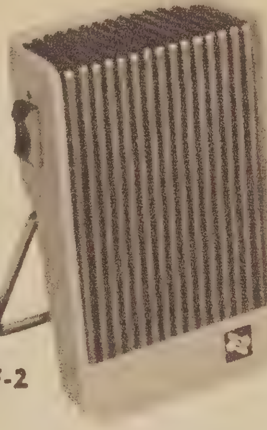
PYE PTY. LTD.
CRYSTAL DIVISION
CLARINDA ROAD, VICTORIA—P.O. Box 105. Tel.: 544-0361.
State Offices in Adelaide, Brisbane, Hobart, Perth and Sydney.

foster dynamic microphones



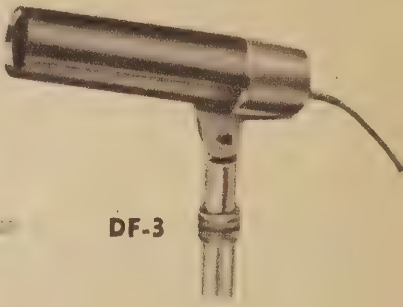
DF-1

50K ohms £5-12-0
50 ohms £4-18-6
Price Retail Plus Tax
Frequency Range
100-12,000 C/S.



DF-2

50K ohms £2-14-0
50 ohms £2-5-7
Price Retail Plus Tax
Frequency Range
200-10,000C/S.



DF-3

50K ohm £4-16-0
50 ohm £3-18-4
Price Retail Plus Tax
Frequency Range
50-15,000 C/S.

ZEPHYR PRODUCTS PTY. LTD.
58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA, AUSTRALIA

AGENTS D. K. Northover & Co.—Neil Muller Ltd.—Homecrafts (Tas.) Pty. Ltd.—Jacoby, Mitchell & Co. Pty. Ltd.—T. H. Martin Pty. Ltd.—P. H. Rothschild & Co. Ltd., New Zealand.

Sure Brite Picture Tubes

ALL TYPES OF TUBES AVAILABLE EXCEPT BONDED

Year Warranty
$10 plus dud

2 Year Warranty
$12 plus dud

Test tubes
$8 (see below)

27 inch $20 plus dud
All prices cash or COD

THESE ARE
TRADE PRICES

FULL WARRANTY:
Any tube returned to Sure Brite under warranty is replaced with another one at no extra charge. regardless of whether it tests good or not, so long as it is not broken.

COUNTRY CUSTOMERS
Rail tubes to Lewisham Station, freight paid. Orders filled same day received. All freight charges to be paid by customer.

LARGE STOCK
We always have 200 to 400 tubes in stock. All Australian types except bonded. When ordering state which price tube you want, otherwise the $12 tube will be supplied.

DELIVERY
Free delivery on tubes Mon. Wed. Fri. inter suburbs only.

TEST TUBES
We have 5 inch 70-deg. type uses focus magnet and no ion trap, and 21 inch 110-deg (110-deg may have spots) $8 each, no dud required.

DUDS
Must be under vacuum and scratch free.
We can sell 17 inch without dud for $6 extra 21 inch without dud for $8 extra. 23" $10 extra.

BENT GUNS AND 12 VOLT
We have the sharper focus bent guns and can supply them in the popular 21 inch 90-deg., also any type can be supplied with 12 volt 300ma heater.

Sure Brite Picture Tubes

22A VICTORIA STREET, LEWISHAM, SYDNEY, N.S.W. PHONE 56-6363

W.I.A. YOUTH RADIO SCHEME

The following report is on a project that as become a very popular event and one hich could be adopted by other organisa- ons interested in youth welfare.

CAMP TECHNOLOGY 1966

The second annual "Camp Technology" as held from December 28th, 1965, to anuary 6th, 1966, at the 'Grange,' Mount ictoria, N.S.W.

This was a holiday camp for boys in- erested in electronics and photography, who re attending second year High School or bove. The camp is sponsored by the Inter- chools Christian Fellowship. The camp ims to teach the boys a basic understand- g of the Christian Faith, and to provide series of graded technical projects to be ompleted during the camp as well as a ood measure of healthy out-door exercise.

On arrival at the camp, all boys intend- g to engage in any electronics project ere given a short 'exam' to grade them to elementary and advanced levels. This as followed by classes in soldering, use of ultimeters and components. Each morning list of elementary and advanced projects eing conducted that day were posted to low the boys to choose their activities r the day.

Projects constructed by the elementary roups were: Crystal sets, one-transistor nplifiers, telephones, transistor multivibra- rs to operate flashing lights, multimeters ncluding the calculation of shunts and ultipliers) and a one-transistor regenera- ve receiver.

The advanced group constructed a three- att audio amplifier, a stereo mixer for tape cording, etc., a "Vox" transmitter control, veral transistorised crystal oscillators, a lid-state series-regulated power supply, a unt-regulated power supply and several ght-operated devices, including an elec- onic "pistol range."

The camp amateur station VK2BCT was erated by Tom Mayne VK2AWM and hn Clark VK2ZEQ, 3.5MC; 7MC; 14MC d 144MC bands. A great deal of interest as shown among the boys and by the end camp quite a number of them could be eard quietly muttering "CQ." Hearty thanks e extended to all those amateurs who ovided QSO's and offered so many good ishes for the success of the camp.

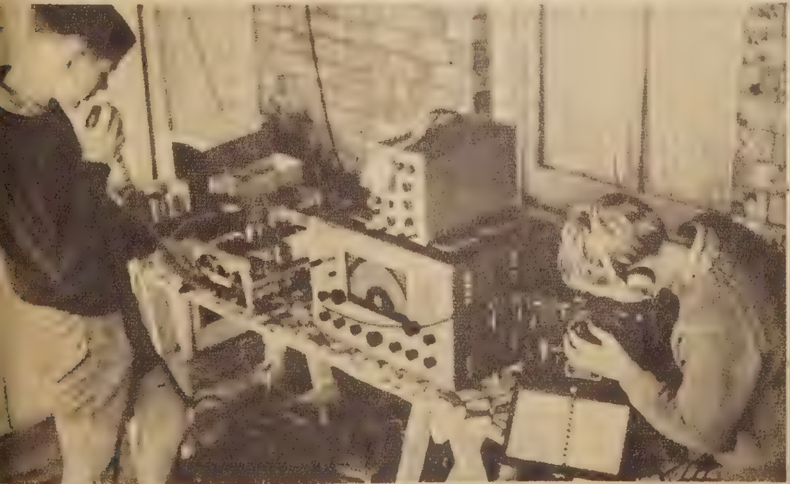
Points of particular interest were the con- cts with VK2BBB, the Bankstown Boys rigade station, which was operating from eir holiday camp in southern Queensland; so the hasty entry into the VHF Field ay following a QSO with VK2ZTM port- le about five minutes before the start of e first session. Approximately 130 QSO's ere logged on all bands during the camp.

As the camp is affiliated with the W.I.A. Youth Radio Scheme, a number of the boys were instructed for and passed the Elementary Certificate test. Results were of a very high standard, one of the boys gaining a prize donated by the Overseas Telecommunications Commission.

On the photography side, a darkroom was in continuous operation and when the two-metre, six-over-six skeleton slot antenna was bent to a 45 degree angle from vertical during a storm, budding press photographers appeared from everywhere. The photographic group ran a course of instruction in developing, printing and enlarging, together with the filming of a 16mm black-and-white movie of the camp. The movie was made by a member of the team who is a professional in this field, ably assisted by a number of the boys as camera crew and film stars.

It is hoped that after editing and the addition of a sound track the film will be available to youth groups and other interested parties.

As mentioned in the October 1965 issue two blind lads successfully completed the Y.R.S. Elementary Certificate Course. Here they are, Cheng Ann Cheok (left) and Norman Salmon.



Two of the boys at "Camp Technology" with some of the equipment made available for them.

DEITRON ELECTRONICS

MAIL ORDER SPECIALISTS
P. O. BOX 86, BROADWAY, N.S.W.

MINIATURE ELECTROLYTIC AND POLYESTER CAPACITORS
WRITE FOR CATALOGUE
TRADE INQUIRIES WELCOME

TRANSISTORISED VARIABLE D.C. POWER SUPPLY
0-20 volts variable. 200 mA. Max. current.
$19.50
75c postage.

MINI-LAB 7 in 1 MULTIMETER
Resistance Substitution. ½W., 5%, 100, 1K, 10K, 100K, 1 megohm. Capacitance Substitution: .002, .005, .02, .1(oil600v) and 10uf. R.F. Signal Generator: 455kc, at 35mV. Audio Generator: 400c.'s (approx.) 35mV. DC and AC Volt ranges: 0-15, 0-50, 0-150, 0-500, R.F. Field strength: 1-140mc. Antenna: 5 section 10¾in. Sizes: 6in x 2¾in x 3⅝in. Battery operated.
COMPLETE $18.75.
Post 50c, interstate 75c.

TRANSISTORISED SIGNAL INJECTOR
2 Tarnsistor, Osc. Voltage 1.5 to 2v. P-P Freq. 400-700cps. plus harmonics.
Price $5.28, Post Free.

TRANSISTORISED SIGNAL TRACER
Gain: over 70dB. Gain control: continuous from 0. Attentuation factor: 0-20-40-60. Input Impedance: AF: over 70Kohm. R.F.: over 100Kohm. Output Impedance: ext. speaker, 8 ohm output.600 ohm unbalanced. Meter: VU 200uA Speaker: 2¼in dynamic. Contains 6 Transistors, 4 diodes, 1 thermistor. Size: 5⅞in x 3⅜in x 2¾in. Battery: 9V, 006P.
$27.05
Complete
Post 50c, interstate 75c.

We have the facilities and spares to service all instruments advertised by us. All inquiries P.O. Box 86, Broadway, N.S.W.

WRITE TODAY TO BE PLACED ON OUR MAILING LIST OF NEW INSTRUMENTS and COMPONENTS

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v opera'ed, complete with speaker and amplifier.

$95.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

$1.25 each. Post 10c.

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule.
1 Lampholder.

$1.85 each

Post.: N.S.W. 30c; Interstate, 40c.

PMG TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line. Complete with 660ft wire.

$23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9 Lens, stops 11, 8, 5.6, 4, 2.9.
With 3" x 8" F1 Dallmeyer Lenses complete with wooden case.

$39.00

50c Cartage to Rail, Freight payable at nearest attended railway station.

ELECTRIC CLOCK MOVEMENTS

Complete with Dial

7in.	$2.75
9in	$3.50

Post.: N.S.W. 25c; Int. 30c.

TRANSFORMER

AGC. Single phase, 1.75 Kva primary volts, 100-200, 110-220. 120-240, 130-260, secondary, 2,200 1,700 at FL. PF equals 1.0. $35.00.

12 CREED TELEPRINTER

Tape printers model 47.R 240 Volts operated.

$35.00

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1.320ft coil of twin (equal ½ mile), $7.00 per coil.
Post., N.S.W. 70c; Interstate $1.20.

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils, $1.25 each.

2-WAY RADIO

NUMBER 22 (AUST.)

Untested without meter or leads, with power supply less relays. $15.00. 50c cartage to rail. Freight payable at nearest attended railway station.

A.W.A. 2-WAY RADIO

6 OR 12 VOLTS.

70 to 80 megacycles, $30.00, or transmitter only $15.00, receiver $15.00. 240 volt power supplies for receivers only $15.00. 50c cartage to rail. Freight payab'e at nearest attended railway station.

POCKET 420 M/CS RECEIVERS

Contain 6 transistors and 3 diodes, pot cores, resistors, etc. Suit conversion to other frequency or for "Foxhunt Sniffers."
Complete in case 3in x 5in x 1in.

$10.00

AWA OSCILLOSCOPE

Calibrated with delay time base 5in, 240 vac. perfect.

$195,00

P.M.G. TYPE PHONE JACKS. 20c each. Post 5c.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

$1.00 each

Post. N.S.W., 25c; Interstate 35c.

PERSPEX

Slightly domed shape, 16in x 12in, $1.55. 2ft 6in x 18in tapering to 6in, $1.75. 2ft 6in x 2ft, $2.45. Domed approximately 3ft 6in x 2ft, $5.50.
50c cartage to rail. Freight payable at nearest attended railway station.

AUDIO AND ULTRASONIC OSCILLATOR

240 volt operated 12 switch selected frequencies in Audio range. 12 ultra-sonic switch selected frequencies, 19in rack mounting unit in Hamm.rtone instrument case.

$25.00

VALVES

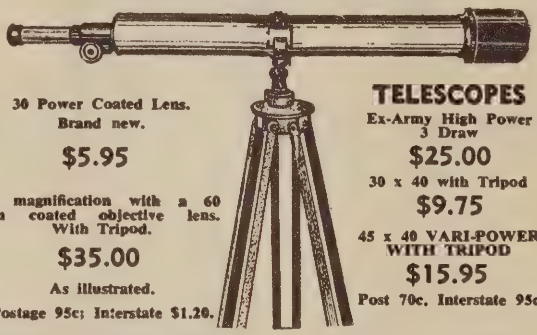
BRAND NEW

IN CARTONS

Special discount for quantity

6SN7GT	95c	6AG5	50c
89	$1.00	X61M	$2.20
12SA7	$1.25	CV850	75c
6H6	45c	18H6G	30c
41	$1.25	832	$5.00
5U4G	95c	6F13	75c
77	$1.00	6AK5	$1.75
VR150-30	$1.00	6X4	$1.00
5CPI	$3.95	6F8	75c
EF50	35c	6N7	$1.00
6U7	75c	12SK7	50c
V1103	$1.00	VR1120	50c
VH120	75c	VR118	75c
1L4	$1.00	VR65	25c
10	$1.00	6R7GT	50c
5Y3	$1.25	VT4C	75c
6C4	50c	AU5	$1.00
CV2184	$2.25	80	$1.25
6AK5	$1.50	6AK5W	$1.50

PLEASE ADD POSTAGE ON ALL ARTICLES



30 Power Coated Lens. Brand new.

$5.95

60 magnification with a 60 mm coated objective lens. With Tripod.

$35.00

As illustrated.

Postage 95c; Interstate $1.20.

TELESCOPES

Ex-Army High Power 3 Draw

$25.00

30 x 40 with Tripod

$9.75

45 x 40 VARI-POWER WITH TRIPOD

$15.95

Post 70c, Interstate 95c

HIGH STABILITY RESISTORS

I.R.C. brand new ½w, 1w, 2w, tolerances between 1 and not exceeding 5% including 100, 360, 560, 750, 15K, 22K, 27K, 100K, 180K, 220K, 560K, 820K, ohms. Usual price 40c each, 50 assorted different values for only

$3.75 Post 15c

ASTRONOMICAL TELESCOPES

3¼in, Reflector, 126 magnification. Complete with 4x finder and equatorial mount.

$59.00

Post.: N.S.W. 70c; Interstate $1.20.

THEODOLITE

Cooke Troughton and Simms, London. Microptic. Tested. Complete with Tripod. $275.00.

522 TRANSCEIVERS

100 to 150 m/cs.

$35.00

TR1934 TRANSCEIVERS

100 to 125 m/cs.

$33.00

GENUINE VARIACS

0-115 V.A.C. 18 Amps $29 each, or couple two together for 240 V.A.C.

The two for $45

Genuine American Zenith Variacs

0-115 V.A.C. 7.5 Amps $19.50 each or couple two together for 240 V.A.C.

The two for $36.

50c cartage to rail. Freight payable at nearest attended Railway Station.

C.M.A. CABLE

240 volt 3/.036 black, new and perfect. 100 yds. rolls, $3.00 6 or more,

$2.50 a roll

30c cartage to rail, Freight payable at nearest attended railway station.

MICROMETERS

Brand new Goodell-Pratt, 0 to 1in, $7.50; Slocombe 1in-2in, $7.85; Starrett 1in-2in, $9.85.

Post 32c.

CHOKES, 7.5H, 60mA 95c
VIBRATORS, 6 volt, 7-pin, 75c each.
UNISELECTORS, 4 BANK HOMING TYPE $4.00
INVERTERS, 26v-115v 2KW 400 cycle $9.50
HAND MICROPHONES, with Press-to-Talk Switch .. 95c ea.
Post. N.S.W. 25c, Interstate 30c.
INSTRUMENT TRIPODS, sturdy wooden frame. Telescopic. Extend to 4ft 6in $13.00
SELSYN MOTORS MAGSLIP Mk. II .. .. $5.25 ea.
No. 19 2-way radios, with hand set, power supply, leads, $35.00
Meggers, bridge type, complete and tested $75.00
EVERSHED and VIGNOLES. 500 volts.

H.T. TRANSFORMERS

2,000/0/2,000 volt. Primary 28 volt 50 cycs. rated at 1.75 Kva., Ideal linear amplifier, etc.

$27.00

BINOCULARS

PRISMATIC. Coated Lenses. Brand new. Complete with case.

8 x 30	$19.50
7 x 50	$26.50
10 x 50	$27.50
12 x 50	$28.50

Post. N.S.W. 70c, Interstate $1.20

SPECIAL ARMY RELEASE

TELESCOPES

ALL LENSES "ASTRONOMICAL" QUALITY

General and Marine Use

4 x 40 Genuine HANDLEY. Cost $60.00. Our Price $6.50
7 x 40 GENUINE OTWAY ANGLE TELESCOPE. Cost $90. Our Price $9.85
15 x 40 variable Power Otway, $15.50.

Freight payable at nearest attended Railway Station.

420 Mc/s OSCILLATOR

Self-excited 6J6 with power supply and modulation transformer, 5in x 5in x 5in box. 240 volt operated.

$15.00

SHIPS CLOCKS

Seth-Thomas (no bell) eight-day fully jewelled, costs $120.00. Brass 7" $25.00, splash-proof bakelite 10½" $30.00. Posted N.S.W. 70c, Interstate $1.20.

RECORDING TAPES

SCOTCH BRAND
EX WOOMERA
SLIGHTLY USED
PERFECT ORDER

Can be used for home video, tape recording equipment, etc.
2,400ft 12in Reel ½in Top Grade. Cost $14.50. Our price $7.50 roll. Post 70c, Interstate 95c.
Also same in ¼in. Ideal for professional quality audio recording.
1200ft 7in reel ¼in $2.75. Post 12c
600ft 5in reel ¼in $1.68. Post 12c
200ft 3in reel ¼in 65c. Post 10c

SCOOP PURCHASE

Gramo. Motors. New. Made in U.S.A. 4-speed. 240 volt AC. 50 cyc. Only $2.75 each.
Post N.S.W. 30c, Interstate 40c.

240-100 VOLT 6KVA TRANSFORMERS

Encased, including switches, as new, $50.
Top grade, full enclosed transformer, 1 Kva primary 218/240 vac. 50 cycs. secondary 6 volt, 37 volt, 53 volt, 60 volt, $30.

LEAD ACID BATTERIES

New 2 volt 1.5 amp $1.75, 12 volt 0.75 amp $3.75.
Post N.S.W. 25c, Interstate 30c.

SPECIAL lucky dip valve offer. 15 new valves in cartons for only $2.00. We haven't got time to sort them, so you reap the benefit.

MINI-WINCH

New weight only 17lb. ½-ton cap. Powered by single cylinder petrol engine made by Irvington (U.S.A.) Original cost $175.

Special $85.00

Post N.S.W. $1.45, Interstate $2.

MICROSCOPES

600 x 3 Objectives, Complete in Wooden Case.
Post N.S.W. 50c, Interstate 60c.

$7.95

TELEPHONES

Sound Powered. Can be used as Microphone and Receiver. New. With 50ft cable.

$3.85 pair

Post 25c, Interstate 40c.

DEITCH BROS.

70 OXFORD ST., SYDNEY

Between Crown and Riley Streets, City.

SORRY, NO C.O.D.

The organisers considered that the camp was extremely successful and plans have been made for it to be held again next year. Thanks are also extended to the business firms and others who donated or lent components and equipment for use in camp projects.

Fairchild Aust. Pty. Ltd., Caroline Street, South Yarra, Victoria have donated a quantity of silicon n-p-n transistors to the Victorian division. These will be distributed among the Y.R.S. clubs affiliated with the scheme in Victoria. The committee express their sincere thanks to Fairchild for their generous gift.

Doctor Warwicke has been transferred from Sale, where he established the Youth Radio Club at Saint Annes. Mr Rod Champness VK3UG has consented to act as club leader for 1966 and to continue the work of preparing students for the Y.R.S. certificate examinations.

The Warrnambool Technical College Radio Club has received the call sign VK3-AWG and club instructor, Chris Hall, would like to arrange skeds with other licensed Y.R.S. clubs. The equipment at the club consists of a Heathkit Cheyenne transmitter and a Heathkit HR20 receiver. The college is located in Grafton Road, Warrnambool, Victoria. Club members would like to hear from other clubs affiliated with the Y.R.S.

DISPOSAL EQUIPMENT

Identifying surplus military equipment is a problem which confronts most amateurs today. Trying to tell what functions these many interesting pieces performed, from code groups, can be most frustrating.

Information on these identification coding systems was given in a recent issue of the "Electronic Experimenters' Club News," a brochure published in California, and may assist in deciphering some of these codes.

There are three such systems used on equipment found on the disposals market today. The oldest is the Signal Corps System, which has been discontinued because there was no way of knowing from the designations which individual components belonged to a complete system.

The following are some of the more common Signal Corps prefix letters and their meanings:

SCR	Set Complete Radio
AN	Antenna
BC	Basic component
DM	Dynamotor
PL	Plug
FT	Mount, rack or adapter
RA	Rectifier Power Supply
TS	Test Set

Under this system an overall equipment was SCR, followed by an arbitrary number and suffix letter which represented the model or modification. However, there was no way to indicate, for example, that the BC-453A was the receiver or the BC-547A the transmitter in the SCR-274N. Also, one could not tell, from the designation, that the SCR-274N was used in aircraft for two-way radio communications.

The second, although no longer used to any extent, is the Navy Model Letter System. Equipment identified under this system is still in use. The assignments of letters depends on the primary function of the equipment. The first letter indicates the basic purpose of the equipment, except where the word MARK is used to indicate Bureau of Ordance equipment.

The second letter indicates the order in which the designation was assigned, except for the letter "X," which indicates experimental equipment. The letters TA, for example, would indicate the first transmitting equipment assigned, TB the next and so on. Triple letters like TAA, TBA, etc., are used when the simple alphabet is exhausted.

Coding designations are:—

A	Airborne installations
B	IFF (identification friend or foe)
CX	Commercial experimental
D	Radio direction finding
E	Emergency power
FS	Frequency shift keying
G	Aircraft transmitting (superseded by "A")
J	Sonar listening (receiving)
K	Sonar transmitting
L	Precision calibrating
M	Combined radio transmitting and receiving
N	Sonar navigational aids (echo sounding)
O	Operator training and measuring
P	Automatic transmitting and receiving
Q	Sonar ranging
R	Radio receiving
S	Search radar
T	Radio transmitting (includes combination transmitting and receiving)
U	Remote control (automatic keyers)
V	Radar repeaters
W	Combined sonar ranging and sounding
X	Experimental
Y	Navigational and landing aids
Z	(Superseded by "Y")

The system now in use to identify electronic equipment, including independent units that are not parts of specific equipment, is known as the Joint Nomenclature System ("AN" System).

Complete systems are designated by three equipment indicator letters that follow AN/, and signify the kind of installation, type of equipment and its purpose.

Using the letters in the following tables, the AN/ARC-3, for example, is identified as follows. The A means it is installed in aircraft, the R means it is radio equipment and the C means it is used for transmitting and receiving communications. The number 3 indicates this was the third equipment designated with the letters ARC.

The system indicator letters "AN" do not mean that the Army, Navy and Air Force all use the same equipment, but simply that the type number was assigned in the "AN" system.

INSTALLATION (1st Letter)

A	Airborne (installed and operated in aircraft)
B	Underwater mobile (submarine)
C	Air transportable (obsolete)
D	Pilotless carrier
F	Ground fixed
G	Ground, general ground use
K	Amphibious
M	Ground mobile
P	Ground pack or portable
S	Water surface craft
T	Ground transportable
U	General utility (two or more general installation classes. Airborne, shipboard and ground)
V	Ground, vehicular (in vehicles not primarily designed for carrying electronic equipment)
W	Underwater fixed

TYPE OF EQUIPMENT (2nd letter)

A	Invisible light, heat radiation
B	Pigeon
C	Carrier (wire)
F	Photographic
G	Telegraph or teletype (wire)
I	Interphone and public address
K	Telemetering
M	Meteorological
N	Sound in Air
P	Radar
Q	Underwater sound
R	Radio
S	Special types (magnetic, etc.)
T	Telephone
V	Visual and visible light
X	Facsimile or television

PURPOSE (3rd letter)

A	Auxiliary assemblies (not complete operating sets)
B	Bombing
C	Communications (receiving and transmitting)
D	Direction finder
G	Gun directing
H	Recording (sound, photographic and meteorological)
J	Countermeasures (receiving and transmitting)
L	Searchlight control
M	Maintenance and test assemblies
N	Navigational aids (altimeters, beacon compasses, depth sounding, instrument landing)
P	Reproducing (photo and sound)
Q	Special or combination of types
R	Receiving or listening
S	Detecting and/or range or bearing
T	Transmitting
W	Remote control
X	Identification and recognition

Independent units not part of, or used with, specific sets have a type number consisting of a component indicator letter, a number, the slant (/), and whatever equipment indicator letters (from the previous table) apply. Using the R44/ARR-5 as an example, R44 is the independent component designation of Airborne Radio Receiver (No. 5 in the ARR series).

Examples of the component indicator letters in the "AN" series are:—

AM	Amplifiers
AT	Antenna
CG	Cables and transmission line (R.F.)
FR	Frequency measuring device
IP	Indicators, cathode ray tube
MD	Modulators
O	Oscillators
PP	Power supplies
R	Radio and radar receivers
RF	Radio frequency components
RG	Cables and transmission lines, bulk RF
RT	Receiver and transmitter
SG	Signal generators
T	Radio and radar transmitters
TF	Transformers
TN	Tuning unit
TT	Teletypewriter and facsimile apparatus
ZM	Impedance measuring device

PHILCO
SOLID STATE PRODUCTS

BANDWIDTH VS SWITCHING RATIO

TYPICAL SWITCH SPECIFICATIONS

FREQ.	IL	ISOLATION
9.0—9.5 Gc	1.0 db	55 db
16—17 Gc	1.2 db	45 db
22—24 Gc	2.0 db	60 db

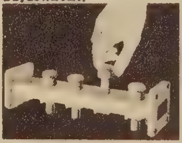
We offer a complete line of waveguide and coaxial switches with a number of very distinct advantages. Let's put it in the form of a proposition:

You tell us your required switching ratio and insertion loss, and we'll offer you a broader bandwidth than anyone else can.

Or tell us your bandwidth requirements, and we'll give you a better switching ratio or insertion loss.

In waveguides we utilise self-resonant switching diodes, which require no frequency-sensitive tuning elements whatever.

And our diodes are field-replaceable. Replacement diodes may be specified from our standard lines and require no tuning or readjustment.



In addition, we have developed a low-loss package design to achieve extremely low insertion loss in waveguide switches, less than ½ db all the way up to 26 Gc.

The versatility of our coaxial switches is further extended by this stratagem: We offer coaxial switches using the low-loss diodes originally designed for waveguide switches — to achieve extremely high switching ratios with low insertion losses.

Sole Australian Representative

D. R. Johnston and Co. Pty. Ltd.

Suite 14. "Stanhill 33"
Queens Road, Melbourne.

TELEPHONE 26-1381—TELEGRAMS
& CABLES, "VIATON," MELBOURNE.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

PHONE 51-384

RADIO

136 VICTORIA ROAD, MARRICKVILLE, SYDNEY,
AND 636 KING STREET, NEWTOWN—51-7008

K 20 CT330 **K 20** CT500

220S 4000 O.P.V.

D.C. Volts 5, 25, 125, 500, 2500. A.C. Volts 10, 50, 250, 1000. Current. 250uA, 250mA. Resistance 0-10K, 0.1 Meg.

£3/19/6 Post 5/-

C.T.330 20K.OPV

D.C. Volts, .6, 6, 30, 120, 600, 1200. 3000, 6000 A.C. Volts, 6, 30, 120, 600, 1200. D.C. Current, .06-6, 60. 600mA. Resistance. 6K, 600K, 6meg., 60meg. D.B. minus 20 to plus 62. 5 Ranges. Specially suitable for transistor use. **£7/19/6** Post 5/.

C.T.500 20K.OPV

D.C. Volts, 2.5, 10, 50, 250, 500, 1000. A.C. Volts, 10, 50, 250, 500. 1000. D.C. Current, .05, 5.50, 500mA. Resistance, 12K, 120K, 1.2meg., 12meg. D.B. minus 20 to plus 62.

£6/12/6 Post 5/.

S.E.550 100K.OPV

D.C. Volts, .5, 2.5, 10, 50, 250, 500. 1000. A.C. Volts, 2.5, 10, 50. 250, 1000 D.C. Current, 10uA, 2.5, 25. 250mA, 10 amps. Resistance, 2K 200K, 2M, 20M, D.B. minus 20 to plus 62.

£10/7/6 Post, 7/6.

P.T.34 1000.OPV

D.C. Volts. 0, 10 50, 250, 500, 1,000.
A.C. Volts. 0, 10, 50, 250, 500, 1,000.
M.A. 1-100-500 RESISTANCE.

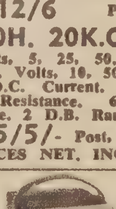
£2/12/6 Post 5/.

200H. 20K.OPV

D.C. Volts, 5, 25, 50, 250, 500, 2500. A.C. Volts, 10, 50, 100, 500. 1000. D.C. Current. 50uA, 2.5, 250mA. Resistance. 6K, 600K. Capacitance. 2 D.B. Ranges.

£5/5/- Post, 5/.

ALL PRICES NET. INC. S./TAX.



V.T.V.M.

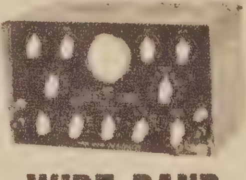
27 Ranges A.C. Powered.
D.C.V. 0, 1.5, 5, 15, 50, 150, 500, 1,500.
A.C.V. 0, 1.5, 5, 15, 50, 150. 500, 1,500 R.M.S.
A.C.V. P. to P. 0, 1.4, 4, 14, 40, 140, 400, 1,400, 4,000.
Resistance 1 ohm to 1,000 megohm.
D.B. — 10 D.B. to + 65 D.B.

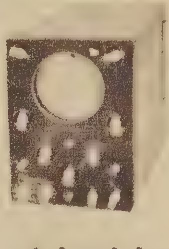
£21/5/-

Post 10/.

H.V. Probe to 30 KV, £4/2/6.
T.M.K. Units, £26/15/-

TEST EQUIPMENT





WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

3-inch $99.75; 5-inch $111.50

4 CHANNEL MICROPHONE MIXER PRE AMPLIFIER

$7.75

Post 5/.

TRANSISTORISED VARIABLE POWER SUPPLY

Range to 20V, 200MA.

$18.75

Post 5/.

MINILAB 7in 1 MULTIMETER

$16.75

Post 5/.

STEREO PRE AMPLIFIER

240 V. A.C. Power
To suit magnetic P.U. tape or microphone.
Response 20 to 20,000 cycles.
Gain 60 D.B.

$15.50

Post 50c

G.D.O. UNITS

Leader. 810. 6-Band. 2 Meg. to 260 Meg. Nuvistorised. 240 V.A.C. Operation. Modulated. Calibration Accuracy 2 per cent.

£19/15/-

T.E. 18 Lafayette. 8 Bands. 360 K.C. to 260 Megs. 240 V.A.C. operation.

£19/15/-

Post N.S.W., 5/; Interstate, 7/6.

LEADER SWEEP & MARKER GENERATOR

TV and F.M. 2 to 270 Megs. 5.5 Meg. Crystal for TV sound, Sweep width to 12 Megs. Model 531.

£69-10-0

Model 532

£85-0-0

Post N.S.W., 15/; Interstae £1/5/.

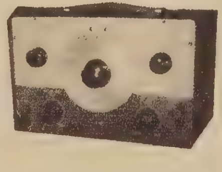
PANEL METERS

EDGE TYPE

1 mA. Scaled. S. Meter. Stereo Balance. Tuning. **£1/5/-**

2" 3" 4" PLASTIC COVERED PANEL UNITS

Latest P series ¾in Barrel 50 mmA. 200 mmA. 1mA, 10 mA 500mA, 1 Amp, 10 Amp. 15V. 500V. **From £1/10/-**



T.E. 20 RF SIGNAL GENERATOR

Freq. 120KC—260MCS in 6 bands.
Output (RF)—High 100,000uV max. Low 100uV max.
Output (Audio)—400 cps approx. 8V.
Modulation — 400 cps internal.
Operation — 240V AC.
Dimensions 7in x 10½in x 5½in.
Weight — 9lb.
Complete with Instruction Book circuit.

£13/5/-

Post N.S.W. 7/6; Interstate 12/6.

LEADER SIGNAL GENERATOR LSG 11

240v A.C. Powered.
6 Band, 120 Kc to 390 Megs.
Provision for Crystal.
An Ideal TV Marker Generator.

£14/15/-

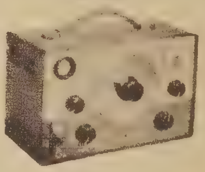
Post. N.S.W. 7/6, Interstate 12/

SIGNAL INJECTOR

Transistorised. Fountain Pen siz Unit for Signal Tracer in Radi TV and Amplifier Service.

£2/7/6

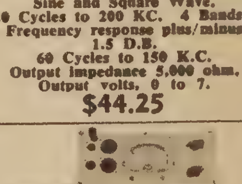
POST 2/6.



T.E.46 RESISTANCE-CAPACITANCE

Bridge and Analyser
Capacity 20 pfd to 2,000 mfd.
Resistance 2 ohm to 200 megs.
Also tests power, factor, leakag impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
Indications by eye and meter

$51.95



T.E.22 AUDIO GENERATOR

Sine and Square Wave.
20 Cycles to 200 KC. 4 Bands.
Frequency response plus/minus 1.5 D.B.
60 Cycles to 150 K.C.
Output impedance 5,000 ohm.
Output volts, 0 to 7.

$44.25

VALVE TESTER

Tests all valves, diodes, rectifie checking filaments, shorts. Merit direct reading. Good-bad mete Complete with tube chart.

$26.75

Post. N.S.W. 7/6, Interstate 12

T.E. 50.—99—5011

Checks. Nu Vistas, Compactron etc.

$34.25

A.C.E. RADIO

AMPLIFICATION
COMMUNICATION
ELECTRONICS

PHONE 51-3845

636 KING STREET, NEWTOWN—51-7008

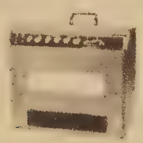
136 VICTORIA ROAD, MARRICKVILLE — 51-3845

PLAYMASTER 4 STEREO AMPLIFIERS

Push-Pull. 8 Watt per Channel Bass and Treble boost and Cut. Wired and Tested.

£38/10/- $77.00

Buyers please note: Due to component and production cost increases we regret the price of P.A. Amplifiers, Guitar Amps. and Stereo Amps. will be increased in the near future.



GUITAR AMPLIFIERS

10-Watt, Two Channel, with Twin Cone Speaker. £25/15/-.

14-Watt, 4 Inputs, Bass and Treble Boost. 2 Twin Cone Speakers. £29/15/-.

17-Watt. Four-Channel. Bass and Treble Boost. Two Twin Cone Speakers. £36/17/6.

35 WATT

4-Channel. Bass and Treble Boost. 4 Twin-Cone Speakers .. £52/10/-
60-Watt, 2 Unit
4-12in Auditorium Speakers.

£85/17/6

Vibrato with foot control and 2 pre-set controls for frequency and intensity. £5/5/- extra on above models.

14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. 2 9 x 6 Woofer Speakers. 2 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato Control included.

£81/15/-

SLAP BASS OR BASS GUITAR 40 WATT AMPLIFIER

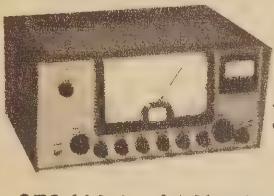
4 Input Channels. Bass and Treble Boost. 2 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

£72/17/6

PIGGY BACK GUITAR AMPLIFIER

30 Watt	£39	17	6
45 Watt	£49	17	6
60 Watt	£59	17	6

4 Inputs. Bass and Treble Boost. Vibrato if required. £5/5/ extra.



£72/10/ $145.00

1965 COMMUNICATIONS 8

R. TV and H., January

This outstanding receiver for Ham or General use.

Wired — Tested Guaranteed

With mechanical filter.

£20 $40 Extra

TRANSISTOR CAR RADIO

Push-button operation. High sensitivity. Tailored to fit most modern cars. 6v or 12v operation — state voltage. Polarity and speaker size.

£29 Complete

NEW RECORDING TAPE

5¾" 850ft	1	2	6
3in Mylar L.P. 300ft		10	6
5¾in Mylar L.P. 1150ft ..	1	7	6
5¾in Mylar D.P. 1650ft ..	1	17	6
7in P.V.C. 1200ft	1	5	0
7in Mylar L.P. 1800ft ..	1	17	6
7in Mylar D.P. 2400ft	2	15	0
10½in Mylar L.P. 3500ft ..	4	15	0

Post 2/6 per Spool.

P.A. SPEAKERS

8 WATT
8in Units in Waterproof Projection Horns.
15 Ohm Voice Coils.

£6/15/-

In Double Ended Flares. Duolateral Coverage.

£7/5/-

Line Output Transformers to suit, 17/6 extra.

P.A. SPEAKER DRIVER UNITS

American Rating. 30 Watts. Voice Coil 16 ohm.

£10/15/-

15 Watt Rating.

£7/17/6

REFLEX HORNS TO SUIT.

£10/15/-

WEEKEND — HOLIDAY — EVENING DEMONSTRATIONS AT COLLAROY

PHONE XW5956 FOR APPOINTMENT TO TEST STEREO GUITAR AMPLIFIERS AND TELEVISION.

BATTERY CHARGER

240 Volt A.C. Operation

3 Rate 6V, 12V TRICKLE CHARGE

Trickle Charge Position suits all Batteries. 2V to 12V at rate of 200 to 500 M.A.

STANDARD

2 amp. 6V, 12V, TRC £5/15/-
3 amp. 6V. 12V. TRC £6/12/6
4 amp. 6V. 12V. TRC £7/12/6
5 amp. 6V, 12V £7/19/6
Post., N.S.W. 7/6, Interstate 12/6.

DE LUXE

1½ amp., 6v-12v £4/17/6
3 amp. £8/7/6
4 amp. £9/17/6
6 amp. £10/17/6
10 amp. £13/17/6
Rail or Air Freight on.

Complete £14/5/

PLAYMASTER BOOK SHELF UNITS

To R, TV & H specifications. Mountain Ash, Maple or Walnut formica finish.

ALSO CABINETS ONLY

To suit 6",	8" and	12" speakers
£5/15/	£6/15/	£8/15/
$11.50	$13.50	$17.50

REVERBERATION UNITS

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

£2/17/6 $5.75

Post. 3/6.

ELEGA REVERB. SPEAKERS

Automatic addition of reverberation to any existing amplifier. Handles 12 watts.

£12/15/- $25.50

CO-AXIAL SPEAKERS

C.S-30. 12"

V.C. 16 ohm. Cross over 3,000 cycle. Frequency range 30 to 20,000 cycles. Rated 20 watts.

£13/19/6 $27.95

C.S-20. 8"

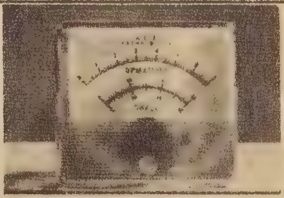
V.C. 16 ohm. Cross over. 3,000 cycle. Frequency Range 40 to 20,000 cycles. Rated 8 watts.

£7/19/6 $15.95

HORN TWEETER CT-3

2,000-20,000 Response.
20 Watts Power.
Sensitivity 110 dbw.
Weight 1¼lb.

£4/9/6 $8.95



MULLARD-A.C.E. TACHOMETER

Wired and tested.

£10/7/6

"Electronics Australia", July, August issue. State max. revs., voltage, polarity cylinders.

METER ONLY

£3-7-6

INCLUDING DWELL. ANGLE FACILITY.

£11/12/6

Post.: N.S.W., 5/; interstate. 7/6.

A. C. E. AMPLIFICATION COMMUNICATION ELECTRONICS

PHONE 51-3845

RADIO

636 KING STREET, NEWTOWN—51-7008

136 VICTORIA ROAD, MARRICKVILLE — 51-3845

B.S.R.

4 TRACK DECK
£17/15/-

2 Track, 3 Speed.
£17/15/-

4 Track, 3 Speed. Mono or Stereo.
£22/12/6

4-TRACK. 3-SPEED. 3 HEADS.
£24/15/0

BRADMATIC HEADS
Latest ½ Track. Hi Fi.
£4/15/- Pair

THE NEW COLLARO TAPE DECK

Takes 7in spool.
3 speeds 1⅞, 3¾, 7½ i.p.s.
2 track £22.
4 track £24.
Write for particulars.

TRANSISTOR POWER SUPPLIES

12v. D.C. Input. 300v. 150Ma. Output plus 150v. Output.
£11/17/6

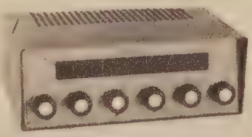
12v. D.C. Input. 400v. 150Ma. Output plus 200v. Output.
£14/17/6

VARY. A.C.S.

240-270V 50 cycle 5 amp. Provide infinitely variable AC voltage.
£14/15/-

2½ Amp as above
£11/15/-

PLAYMASTER 106 AND 107



Feb. and March R. TV & H.

106
WIRED AND TESTED. **$88.75**

107
WIRED AND TESTED. **$79.00**

ELECTRIC GUITAR

Pickup Units	£4	7	6
Accordion Pickup Units	£4	7	6
Harmonica Pickup Units		19	6

Post., N.S.W., 4/; Interstate, 7/6.

SPEAKER VENTED ENCLOSURES

With 8in Twin Cone Speakers Fitted. **£9/10/- Each**

Vented Enclosures for 12in Speakers. 8½ c. ft. **£11/15/-**

Transistor-Ignition HI-SPARK

Simple installation.
38 K.V. output.
Complete. Tested.
Negative earth.
$33.50 £16/15/-

Positive earth.
$4.50 £20/15/-

State voltage and polarity.
Post: N.S.W. 7/6; Interstate 12/6.

CITIZENS BAND

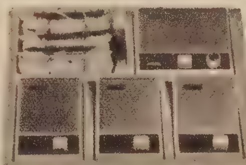
27.240 Megs.
10 Transistor Transceivers.
100 M.W. output
$45.00

1 watt. 15 transistor, with squelch provision for two channels. Range to 10 miles under ideal conditions.
$80.00 £40 each

INTER. COM. UNITS

2 Station Transistorised
£5/15/-

4 Station including Master
£10/2/6



New Telephone Amplifier

Transistorised.
$11.50 £5/15/-
Post 3/6.

T.V. TUNERS

New 10-channel Tuners.
$15.00 £7/10/-
Post 7/6.

LATEST 4-SPEED PLAYERS

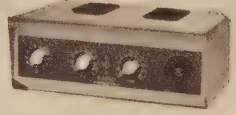
240V A.C. Mono	£5	15	0
240V A.C. Stereo	8	10	0
Battery Mono	9	15	0
Battery Stereo	10	15	0
Battery Mono 45 r.p.m. in Cabinet	4	12	6

Post. N.S.W. 7/6, Interstate 12/6.

Send for full details on Radiogram Chassis, TV and Amplifiers.

AMPLIFIERS

Public Address Range 240V-AC



MINIATURE P.A. AMPLIFIER. 15 WATTS OUTPUT.

Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output. $39.50
30 Watt. As above EL34 P.P. $53.50
40 Watt. As above EL34 P.P. $79.50
60 Watt. As above EL34 P.P. $98.50

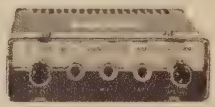
LINE OR VOICE COIL TRANSFORMERS. MULLARD HI-FI RANGE.

5/10 with pre amp base and treble boost. Ultra Linear output £21/15/-
5/20. As above £32/15/-

BATTERY-AC OPERATION

6 valve 6v plus 240v-10 watt $55.50
7 Valve 12v plus 240v-12 watt $59.75
7 Valve 12v plus 240v-25 watt $71.75

TRANSISTOR P.A. AMPLIFIER C.A.-512



12VDC Operation
Output 20 watts
Current consumption at max. output. 2.2 amps.
Input. High imp. mic. Also 600 ohms and tape.
Independent gain controls.
Output: Imp. 4-8-16 ohms.
Freq. Response: 200 cps—6000 cps
Dimensions 2in x 6¼in x 8½in.
Complete with instruction book with circuit. All plugs.

PRICE £28/15/-

DYNAMIC MICROPHONES

DM -391 Hi-Imp	£1	15	0
DM -175 Hi-Imp	£2	7	6
DMS-3 Hi-Imp	£2	15	0
DM -305. 600 ohms or Hi-Imp. Suitable stand mounting ..	£4	17	6
DM-304. Dynamic Cardioid. 50 ohms or Hi-Imp. Suitable stand mounting ..	£7	17	6
CM -10 Crystal Hi-Imp Suit. stand mount.	£2	10	0

Post N.S.W. 2/6; Interstate 3/6.

WIDE RANGE LIGHTWEIGHT STEREO PICK-UPS

Ceramic Units. Sapphire Styli	£3	10
Diamond Styli	£5	5
Universal Ceramic Stereo Cartridge. Sapphire. Styli	£1	9
Diamond Styli	£3	5

NEW WIDE RANGE SPEAKERS

15 ohm. Twin Cone

8in	3	10
12in	3	19
5in	2	5
5in Tweeter	1	17
4in Single Tweeter	1	7
12in Heavy Duty 20 watt	£7/15/	

P.A. REFLEX HORNS

WITH UNITS

5 Watt 8 ohm	7	5
10 Watt 8 ohm	13	5
35 Watt 15 ohm	18	0

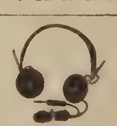
N.B.: As these are American ratings, divide the wattage by 2.

STEREO RECORD CHANGERS

1965 model. 4-speed.
£10/15/

De Luxe Model.
Fully machined and balanced. Heavyweight turntable. Ceramic cartridge.
£13/15/

Post. N.S.W. 12/6. Interstate 17/6.



STEREOPHONIC HI-FI HEADPHONES

With padded earpieces
SPECIFICATION . . . .
Frequency Response 25—17000 cps
Nominal Power 1 watt.
V.C. Imp. 8 ohms each channel
£3/17/6 Post 5/.

PHILIPS DISC JOCKEY

4-Speed Players.
6V. D.C. OPERATION.
MONAURAL CRYSTAL HEAD
£4/17/6

STEREO.
£5/17/6

Post. N.S.W. 7/6. Interstate, 12/6

MORSE KEYS

New lightweight, fully adjustable un
9/6

As above with buzzer.
Complete Morse practice set.
16/6

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Third Relay Station on Bonaire

A third relay station will soon be operating from the Caribbean island of Bonaire, following the conclusion of an agreement between the Government of the Netherlands Antilles and the Radio Nederlands organisation, of Hilversum.

he new relay station is expected to be ned by Radio Nederlands in the ning year. The first relay station was into operation when Trans World Radio ne into service in 1963; this station ried the gospel service of Trans World dio and also carried relays of Radio derlands to African and American audi- es.

ast month Deutche Welle in Cologne ounced that it would soon begin build- a relay station in the Bonaire area to ry Voice of Germany transmissions to eners on the American continent. The d station, to be built by Radio Neder- ds, will utilise its own transmitters to y Radio Nederlands broadcasts. At pre- t these are relayed by Trans World dio transmitters.

adio Nederlands has concluded an eement with the Antilles Government to blish the station on Bonaire. The Radio derlands Director-General, when making announcement in Curacao, said the tch Government would provide the funds, the station would take some years to ld. He also announced that two 250KW nsmitters would be installed, that by ans of special aerials high signal gain ld be achieved, and that transmissions ld be on short-wave as well as on dium wave.

tudio accommodation will be built, but major part of the program will be yed from Hilversum in Holland. Radio derlands has had considerable experience this type of work, as it has used Trans rld Radio facilities on Bonaire since 3.

BECHUANALAND RELAY

he Rhodesian crisis and the subsequent continuation by the Rhodesian Broad- ting Corporation of BBC news relays m its Salisbury station has forced the C to open a relay base close to the odesian border, and so a new station been put into operation in Bechuana- d, some 16 miles from the Rhodesian der. This new station will relay the BBC ndon programs in the World and African vices. The station is operating on the adcast band frequency of 908KC and s two short-wave frequencies in the 41 62 metre band. Full details on the edule and power of the station are not known, but we have noted at 0600GMT relay of the BBC World Service on 0KC, a frequency not in use by the C London, and this could be one of the short-wave frequencies. The trans- ters were flown into the new site and cted quickly in order to provide the odesian listener with a continuation of C programs.

he location of the new BBC relay ions in Bechuanaland is Francistown, the power on 908KC in 50KW. The second short-wave outlet has been heard in Europe at 0400 with BBC news, and is on 5015KC. The station announces as "This is Francistown. The time is 6 o'clock," then follows the BBC 0400GMT news bulletin.

The local station, Radio Bechuanaland Gaberones, has been testing from 1200 on 3356KC, with announcements in English. The station has a relay of the local program from 1600-1730 on the same frequency and uses 1KW.

TESTS FROM RED CROSS

The International Committee of the Red Cross in Geneva has announced its plans for tests on 7210KC for 1966, when the frequency will be used to find its worldwide reception possibilities. Dates for tests are March 21, 23, 25; May 9, 11, 13; July 4, 6, 8; September 19, 21, 23; November 21, 23, 25. Each test will be 0600-0700, 1130-1230, 1500-1600, 2100-2200. The committee would appreciate reports from listeners, and will issue a diploma to those who report these tests on a regular basis. The tests are in six languages, 10 minutes of each, with English being heard 30 minutes after the commencement of the transmission, that is at 0630, 1200, 1530, 2130GMT.

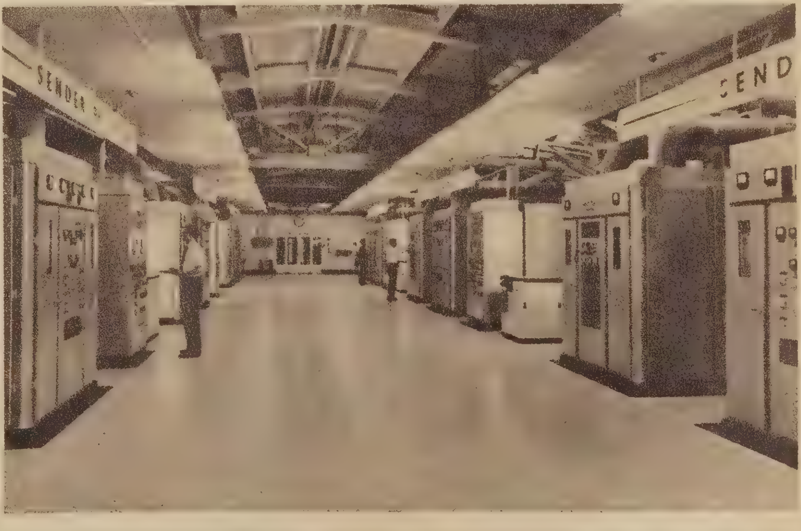
The announcement of the test transmissions, heard in January, included a request for reception reports when closing at 0700GMT. The program was for one hour in English, and covered the work of the Red Cross for 1965. It is expected the multi-language transmissions will be introduced again in March.

The closing announcement was: "This is the International Committee of the Red Cross broadcasting from Geneva on 7210 kilocycles, 41.60 metres. We shall be obliged to everyone listening to us today who sends us a brief letter or card giving us a report on reception and mentioning what time of the day they listened, what type of receiver they used and, for those who record our program, the make of their recording equipment. Listeners are reminded that the wavelength allocated to the ICRC is to be used strictly for humanitarian purposes and that general co-operation by all is invaluable, indeed essential, to the Red Cross mission throughout the world. May I remind our correspondents that our address is International Committee of the Red Cross, Geneva, Switzerland. I repeat, International Committee of the Red Cross, Geneva, Switzerland." The transmission then closed with a short musical item.

RADIO BRAZZAVILLE SCHEDULE

The reception of the Radio Brazzaville transmissions from the Congo is reported elsewhere in this issue, with English news at 0615GMT on 11725KC, but the complete schedule of the station, now to hand, offers reception on several other frequencies, with its relays of the ORTF Paris transmissions.

0500-0730: 4785, 5970, 9730, 11725, 15445KC.
1100-1200: 11970, 15445.
1100-1235: 7105, 11710, 15190, 21500.
1300-1400: 17720, 21500.
1400-1700: Sunday only, 7105, 11710, 17720, 21500.
1730-2100: 5970, 7105, 9730, 11890, 15190.

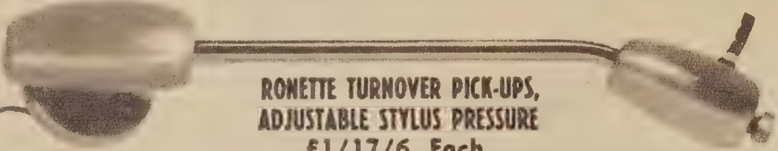


Pictured are six new 250KW transmitters recently supplied by Marconi Co. for the Voice of America relay station at Wooferton, England, which have a total H.F. power of 1.5MW. By the use of trapezoidal modulation, this power is effectively doubled. The technique of trapezoidal modulation is new to broadcasting. The makers claim it allows the signal to overcome heavy interference, and gives an intelligibility at the receiver equivalent to that of a conventional receiver of double the power.

TUDOR RADIO

L. E. CHAPMAN
ESTABLISHED 1940

103 ENMORE ROAD, ENMORE, N.S.W.
PHONE 51-1011 **PHONE 51-1011**



RONETTE TURNOVER PICK-UPS, ADJUSTABLE STYLUS PRESSURE
£1/17/6 Each

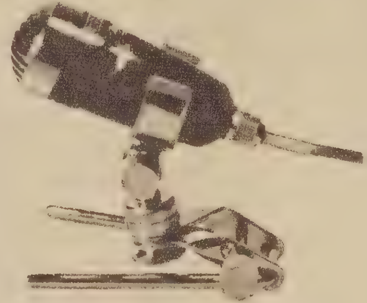
TV CABINETS TO CLEAR

Ideal for speaker enclosure. **£2 each**
Transistor transformers, large **10 0**
Transistor miniature speaker and drive transformer, pair **10 0**
TV safety glass **£1 15 0**
2 and 3 gang Condensers **10 0**
Garrard plug-in Stereo hds. **£2 0 0**
TV masks, 17, 21 or 23 inch **15 0**
POTS 15K, 50M, 1 meg., ½ meg., 0.25, 200M.1in., 50,000 switch, 50K, 20,000. .... **5/- each**
POTS 100K .... **5/ each**
POTS switch, 10K, 25,000, ½ meg., 1 meg., 100K log ...... **7/6 each**
POTS 1 meg. gang **12/6**
10,000 **5/**
POTS Concentric dual, 0.25, 0.25, 0.1 meg., 2,500, 10.000, 0.1 meg., 50,000, 0.1 meg. .. .. .. **5/ each**
TV Power transformers ideal for Amplifiers 300 mil 225 a side .. **£4**
Silicon Diodes 210 ...... **7/6 each**
SPEAKER TRANSFORMERS 3 or 15 o.h.m. **12/6**

STEREO AMPLIFIER KIT SETS

TU 10 3.5 watt per channel, **£12.**
TU 11 including outlets for microphone and tape recorder, **£14.**
TU 12 .5 watt per channel, **£13/10/-**
All kit sets include speakers and every component including valves.
Amplifier kit set 5 watt complete **£11.**
Transistor ear plugs 3 for **10/**
TU 13 watt per channel with TU 11 facilities **£16/-/-.**

TV TUNERS, 13 Channel, New .. .. **£7/10/**, post 7/6
Knobs, long shaft, push on **12/ doz.**
Knobs, for concentric shaft **12/ doz.**
Tag strips, mixed .. .. **6/ doz.**
SPEAKER TRANSFORMERS:
25,000 to 3 ohm **15/**
15,000 to 3 ohm **15/**
250 mixed Screws, self tappers, bolts, nuts, etc. .. **10/** bag, post 2/6
Pots, 200K, 7,500 .. .. **5/**
OAK 4 position Switch **5/**
2 position **2/6**
Crystal Microphones, good quality, ideal tape recorders, etc. .. **£1/8/**
Transistor Speaker Transformers, single ended, 5 watt **15/**
500 ohm Multitap Line Output Transformers **15/**



DYNAMIC MICROPHONE

Good quality, **£4/15/- each.**

Record changers, "Collaro," 78-speed, to clear **£1/10/-.**

SPEAKERS

MSP 20928 12 PQ	£6	15	0
Rola 5 x 4 3a 15 ohm	£1	5	0
Rola 4 x 3 10 15a 27 ohm	£1	0	0
MSP 3½ inch	£1	0	0
MSP 8 inch twin cone 15 ohm	£2	15	0
MSP 6 x 9 twin cone 15 ohm	£2	15	0
MSP 12 inch twin cone 15 ohm	£3	15	0
M.S.P. 7 x 5, 3, 15 ohm	£1	15	0
Rola 5β 3 ohm	£1	0	0

Mini Cable 4 strand shielded, lots of uses including Microphone Cable **1/- yard**
Radio knobs push on **5/- doz.**
Miniature valve sockets 7 and 9 pin **1/- each**
Octal **1/- each**
National power transformers 40 mil. 225 a side **£1 5 0**
TV picture tubes Philips 23 inch new, not regunned, with your dud **£10**
Philips 1F 455KC **7/6 each**
Aerial and Oscillator R.S.C. **5/- each**

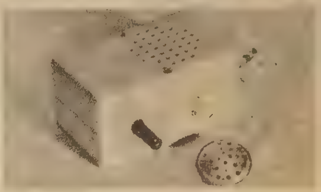
6 x 9 single cone, 15 ohm	£1	15	0
8 inch single cone, 15 ohm	£1	15	0
8 x 4, 15 ohm	£1	15	0
3½ inch, 47 ohm	£1	0	0
6 x 4, 33 ohm	£1	5	0
2 x ¾, 15 ohm	£1	0	0
5 x 3, 47 ohm	£1	0	0
5 x 3, 27 ohm	£1	0	0

Scope soldering iron standard **45/** mini scope **43/3.** Scope delux **49/10,** Vibra-scope **28/.** National scope transformer **54/.**
.TV Transformers voltage doubler **£4**

TV AERIALS

All types **£1/15/0** to **£10.**

TELLY MINI TAPE RECORDER



Specifications:
Record and Play Back.
Push-button Controls.
Playing Time, 30 sec.
Batteries, 2, 3V.
Dimesions: 3 9/16 x 2 3/16 x 1 7/8
Transistors, 4.
Reel Endless, 1 3/8.; Speaker, 1
£6/10/.

PUBLIC ADDRESS SPEAKER HOUSING

for 4, 5, or 6 inch Speakers, £2 eac
Pack. and post, 5/.

2 AMP Fuses, £1/15/ per box 10

OC 70 Diodes, 4/ each.

12-inch Speaker, 2 ohm Rola, £
Pack. and post, 7/6.

Transistor Plastic Outside Case, 5
each.

Transistor Radio Straps, 2/ each.

Stereo Pick-up Arms, £3.

Metal Rectifiers for Battery Electri
Radios, 5/ each, pack and post. 1/

Pilot Light Holders, 3/ dozen.

TV or Cabinet Castors, 4 for 10/

100 Mixed Knobs, including T
Channel Change, £5.

Speaker Transformers M.S.P. 15,00
3 ohm 25,000 3 ohm, 15/.

3 K Pots, 5/ each.

250 K Pots, 5/ each.

TV Chokes, heavy duty, 10/ eac
Pack. and post, 3/.

240-volt AC Record Changers, Stere
£10/15/; pack. and post, N.S.W.
15/-. Mono, £10, Interstate £1/5/

Gramophone Motor and Pick-up, 24
volt A.C., £5/15/. Pack. and pos
10/; interstate 15/.

Push-on Radio Knobs, mixed colour
5/ doz.

23-inch Picture Tubes, new, sligh
burn spot, ideal for set testing, £
each.

OA 70 Diodes, 4/ each.

Morganite and IRC Resistors, mixe
bag, 100 useful values, £1 10
pack. and post. 2/6.

100 Mixed Condensors, fresh stock
£1 bag; pack. and post., 2/6.

Electroyltic Capacitors:
50, 350, 400, 10/ each.
50, 350, 400, 10/ each.
50, 350, 400, 10/ each.

MOSCOW'S PACIFIC SERVICE

Radio Moscow's services to the Australian nd New Zealand listener, carried on both ort-wave and broadcast bands, are on the r for both our morning and evening riods. The transmissions from Moscow e relayed mainly by the Far East relay ation in Siberia to give best reception in e Pacific area. The present service from adio Moscow in English is as follows; 130-2200 on 11690, 9740, 9540, 6160, 960, and 540KC. The frequency 9730KC to be added from March 1. 1130-1200 11690, 9540, 7280, and 710, 620KC. he new BC frequency 710KC came into rvice on March 1. 1230-1300 on 11690, 280, 710 and 620KC. 1330-1400 on 7280, 100, 5960, and 710, 620KC on broadcast nd. Moscow Mailbag is on Saturday and unday at 1145 and 1245GMT.

PUBLICATION REVIEW

The 1966 "WORLD RADIO AND TELE-ISION HANDBOOK," the 20th edition d the Jubilee issue, has been published Denmark. An airmailed copy enables to review this publication, which is now essential part of the short-wave listener's quisites. The Handbook is as complete as er, and its 300 plus pages contain a wealth information for the listener. The station ews, as usual, is very comprehensive, coving all aspects of the activities of the ort-wave stations in each country, with ddress, schedule, frequencies, full program etails, identification signal and announce-ents, verification policy and many other ems on the station and its operation. The andbook lists by frequency all short-wave ations, as well as the long and medium ave stations of Africa, Europe and the ear East, and is illustrated with maps and otos of broadcasters and other people in e radio and television industry.

Some of the other features in the 1966 andbook include articles on call sign locations, colour television, DX clubs of e world, DX programs on short-wave, speranto transmissions, frequency bands located to short-wave and amateurs, news ulletins in English over 24 hours, radio roadcasting reception conditions, radio re-eivers in each country and solar activity 966.

The Handbook is published in Denmark y World Radio Television Handbook Co. td., Sundvej 6, Hellerup and can be ob-ined in Australia from Angus and Robert-on Ltd., and many other technical book-ores; and in New Zealand from Arthur ushen, 212 Earn Street, Invercargill from hom a brochure on the contents of the andbook is available free on request.

STRONG 15MC SIGNALS

Some strong signals from stations in arious continents have been heard in the 9M band, according to our reporters and ur own observations. Desmond Tangey, of allourn, Victoria, reports good reception Peking on 15060KC with the English rvice to Australia, 0930-1030, Bob Padula, Melbourne, lists reception of the Copen-agen 15165KC transmissions opening at 200 in Danish; Helsinki, Finland, on 5185KC opening at 1200 with announce-ents in various languages; Brazzaville on 5190KC with French news at 1830; and igeria, from Lagos on 15255KC, with news 2100GMT. BBC Cyprus relay on 15260 1100 in English and Radio Berlin 15270 Arabic at 1130, while Sofia 15330 also as Arabic 1130-1155. Radio Pyongyang, orth Korea is very strong in English 0400-500 at our location on 15520KC, while olombo Ceylon has been heard on 5330KC in English at 0700GMT.

VOFC ON FIVE CHANNELS

The Voice of Free China, in its trans-issions from Taipe, Taiwan to Australia nd New Zealand, now uses five frequen-ies for the program from 1000GMT. The hannels of 7130, 9655, 9685, 11825 and 1860KC are used, and at present the 1825KC outlet is the best received. The tation program opens with news in Eng-sh and then commentary and musical pro-ram. The Voice of Free China on the island of Taiwan, formerly Formosa, has been heard also at 1230GMT with its request session, in which the Dragon Man plays requests from listeners from many parts of the Pacific area. Voice of Free China transmissions were curtailed recently, but the re-introduction of the 1000 English session will allow us again to hear the enjoyable transmissions from Taipei.

MALAYSIA USES 9740KC

Radio Malaysia, in Kuala Lumpur, with its external services, is using a new 31M channel in its English program, beamed to Australia and New Zealand from 1115-1215GMT. The new channel of 9740KC provides very good reception for the program "The Voice of Malaysia." This new channel replaces 7110KC, but the other frequencies 11900, 6175 and 6105KC are unchanged. The best reception is now on the new frequency 9740 with good signals on 6175KC. Also the other two frequencies give poor reception. The program opens with a commentary, and news is broadcast at 1130, which is equal to 7 p.m. West Malaysian time. The other transmission from Kuala Lumpur in English which gives good reception is on 11900KC at 2400GMT, which has, for many months, been the most consistent signal used for our reception here of the "Voice of Malaysia" programs in English.

FURTHER ETLF TESTS

Further test transmissions beamed towards India and the Near East have been announced by ETLF in Addis Ababa, Ethiopia. The schedule is as follows; 0200-0230 on 11875KC to India; 0300-0330 on 11875 to India, English to India and Ceylon 11755KC 0330-0430, Arabic to Near East on 9705KC and 0330-0400 to Malagasy on 11755; 0400-0430 and 0500-0530 Swahili on 15410KC; 0530-0600 in Hausa and 0600-0630 in English to West Africa on 11930KC. The program in Malagasy, 1500-1540, is now on 0565KC.

RADIO JAPAN BROADCASTS

The Overseas Service of Radio Japan in Tokyo carries transmissions to all areas of the world, and is in addition to the General Service which is heard almost throughout the 24 hours of the day with news in English. The present Overseas schedule from the Tokyo station is as follows:

0000-0100 North America 11780, 15135KC.
0200-0400 Latin America 11780, 15135, 15235.
0600-0700 Hawaii 11705, 15235.
0615-0845 Europe 11780, 15135, 17875.
0930-1030 Australia, New Zealand 11875, 15235.
1230-1430 Philippines, and Indonesia 9525, 11780, 11940.
1430.1600 South-East Asia 9765, 11705, 11875.
1500-1630 South Asia 7195, 9525, 9765.
1645-1845 Middle East and Africa 7195, 9525.
1900-2000 Africa 7195, 9670.

The General Service is heard with English news on the hour, every hour, and gives excellent reception in Australia and New Zealand.

FLASHES FROM EVERYWHERE

FALKLAND ISLANDS is reported from a South African listener as being heard on the new channel of 3951KC broadcasting from Stanley. The station is heard with an earlier sign-off at 01000 GMT. instead of the old sign-off time of 0200, a lady announcer giving the sign-off announcement. The lower signal strength suggests that the station's listed 500W is not being used, and a lower power is being transmitted on this frequency by the Falkland Island Broadcasting Service.

HANOI in North Vietnam, in a verification, lists the transmissions of Radio Hanoi in English on 11640, 11840, 9840, 9760KC, 0500-0515, 1300-1330 and 1530 to 1600 GMT.

BRAZZAVILLE has shown improved signal strength on 11725KC from the Congo, suggesting greatly increased power. From 0530 GMT onwards they are strong, but 15445KC is still of poor signal level. Ern Suffock of South Australia reports that the Brazzaville station relays Paris with news in French at 0600 and that a news bulletin in English is carried at 0615 GMT.

CUBA is reported on the Radio Havana station on two 25M band channels, both heard at 0500 GMT, using 11970 and 11930KC, carrying Spanish transmissions to Latin America.

CAIRO has added another frequency, this one for the program "The Voice of the Arabs," from the Egyptian Broadcasting Service. The 9550KC frequency is heard 1400 to 0120 GMT, as well as on 7050 and 11745KC. This new frequency is additional to the one on 9670KC, which has the English transmission at 2130 GMT, and which is also carried on 11915 and 9475KC.

IRAN's Home Service from 0130 to 1530 is carried on 15110, 7065KC, and also on 11718KC. The period 1530-2300 is on 3780, 7065, 11718KC. From 1730 to 2130 GMT (with English 2000-2030) is now on 7135 and 11718KC. The frequency of 11718KC causes side interference to Montreal on 11720KC.

RWANDA, the site of the new Deutsche Welle relay at Kigali, is to be on the air 0315-0345, 0400-0500 to East Africa, and 0515-0615 to Central Africa, all on 6045KC and also a session in German 2110-2300 on 11770. This is additional to the normal Voice of Germany schedule of this relay station.

AFGHANISTAN has discontinued its German transmissions to the European area, but plans to bring them back into service in May. This is the month which the Radio Afghanistan, Kabul station hopes to put into operation its two new 100KW transmitters, which are at present under construction. This new higher power will enable an extension of its foreign broadcasts.

CHANNEL LOCK

Like having a "THIRD HAND"

No. 46 Heat Sorb Clamp
Self-Gripping Heat Sink
Available All States $1.85

Specially Designed

A specially designed "heat sink" that prevents heat damage to electronic components during soldering operations. Also serves as handy, self-gripping "third hand" that holds and retrieves small parts in close work. Precision-made of light weight aluminum ... easy to handle ... cannot rust.

Sole Australian Distributors: Selectronic Components
6 Central Avenue, Boronia, Victoria, (72) 92233

HAM RADIO SUPPLIERS

5A MELVILLE STREET, HAWTHORN, VICTORIA

Phone 86-6465 **ESTABLISHED 1947**

SINCLAIR X-20

INTEGRATED 20 WATT PULSE WIDTH MODULATED AMPLIFIER AND PRE-AMP

A new concept in high fidelity performance

The use of P.W.M. assures a far better transient response than is possible with other amplifiers and this adds greatly to the quality of reproduction from the speaker.

Harmonic distortion is so low as to be hardly measurable, let alone audible, and cross-over distortion, which can cause such marked unpleasant effects in conventional transistor amplifiers, simply cannot occur at all in the X-20.

Number of transistors:	12
Overall size:	8¼in x 3¼in x1in.
Weight:	4½oz.
Input sensitivity:	1mV into 5kQ.
Total harmonic distortion:	Less than 0.1% at 10 W.

Output power into 7.5 or 8 ohm speaker:
20 watts R.M.S. music power.
15 watts R.M.S. continuous.

Output power into 15 ohm speaker:
15 watts R.M.S. music power.
12 watts R.M.S. continuous.

These output ratings are quoted to the standard British method of rating. Using the method usually employed in the U.S.A., these ratings would be doubled, giving, for example, 40 watts music power into a 7.5 ohm speaker.

Frequency response at all power levels:	20 c/s to 20 kc/s plus 1 db
Damping factor:	Greater than 100.
Quiescent consumption:	About 150 mA.
Supply voltage:	28 to 37 volts (7.5Q speaker). 28 to 45 volts (15Q speaker).
Signal to noise ratio:	Better than 70 dB.
Pulse repetition frequency:	65 to 75 kc/s.

Enegy conversion factor at output at least 95% efficient.

A filter is built into the output of the X-20 so that it may be used with any type of resistive or inductive load of the correct impedance.

X-20 AMPLIFIER

Completely Built and Tested.

Price £16/15/- $33.50

SINCLAIR X-20 AMPLIFIER

Complete Kit of Parts
with instructions for assembly.

Price £13/7/6. $26.75 inc. tax

X-20 A.C. MAINS POWER

Supply (200-240 volts).
Suitable for driving up to
2 x 20 Units.

Price £7/17/6. $15.75 inc. tax

12-VOLT TRANSISTORISED POWER SUPPLY

Q Plus type TPS50/12.
INPUT: 12 volts DC.
OUTPUT: 300 and 150 volt DC 50 watts continuous operation.
FREQ.: 1200 c/s approx.
As-new condition.

Price £11/10/-. $23.00

Post extra.

FERROCART POCKET MULTIMETER

Model PT34

300 uA movement.
AC and DC voltages:
0-10, 0-50, 0-250, 0-500, 0-1,000c.
Current ranges (mA)
0-1, 0-100, 0-500 mA.
Ohms range: 0-100,000
Size 3¾ x 2½ x 1¼ inches.

Price 57/6. $5.75

Complete with leads.

TV BALLUN

ABL 300 Ohm TV Ballun $1.75 (17/6)

FILAMENT TRANSFORMERS

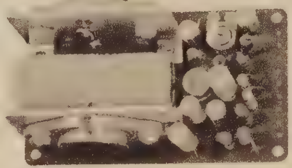
T 4/4 230v.-6.3v 2 amp $3.25 (32/6)
2150 240v.-6.3v-2.5A or 2 x 6.3-1.25A, $3.50 (35/)
2155 240v-6.3v, 7.5, 8.5, 9.5, 12.5, 15v lamp $4.60 (46/)
12/64 240v 6 volt 4 amp-12 volt 4 amp $5 (50/)
12/66 240v 6 volt 6 amp-12 volt 6 amp, $5.75 (57/6)

SINCLAIR Z-12 INTEGRATED HIGH FIDELITY PRE-AMPLIFIER AND 12 WATT AMPLIFIER

PRICE £9/15/ ($19.50)
inc. tax

POWER SUPPLY for Z-12: 6, 9, 12, 15 volts at 1 amp,

PRICE £7/17/6 ($15.75)
inc. tax



SPECIFICATIONS:

No. of transistors: 8.
Overall size: 3in. x 1.8in. x 1.3in.
Weight: 3oz.
Output power into 3 ohm load:
5 watts RMS continuous with 12-volt supply.
8 watts RMS continuous with 15-volt supply.
13 watts RMS continuous with 18-volt supply.
Output power into 1.5 ohm load:
10 watts RMS continuous with 12-volt supply.
16 watts music power with 15V. supply.
Power response: 1.5dB below 1KC at 20KC and 65 cps.
Frequency response: 15 c/s to 50KC plus or minus 1dB.
Input sensitivity: 2mV into 2Kohm.
Quiescent consumption: 12-volt supply—15mA.
Signal to noise ratio: Better than 60mA.
Total distortion: Less than one per cent.

TRANSISTORISED AMPLIFIERS AND TUNERS

LAFAYETTE

PK-522 3 Transistor, Single Ended 50 mW Output $5.75
PK-543 4 Transistor, Push Pull, 100 mW Output $7.50
PK-544 5 Transistor, Push Pull, 250 mW Output $11.75
PK-801 4 Transistor, Push Pull, 1 Watt Output $11.75
PK-633 3 Transistor, 1 Diode, Broadcast AM Tuner $13.50

Kyoritsu
STANDING WAVE RATIO
SENSITIVITY

SWR METERS Model KSW-10

SPECIFICATIONS:

Standing Wave Ratio: 1:1 to 1:10.
Accuracies: plus or minus 3% scale length.
Impedance: 52 ohms and 75 ohms.
Meter: 0-100 DC microamperes.

PRICE £9/10/- $19 inc. Tax.

CRYSTALS

Crystals in FT243 Holders. As New EX SCR536/BC611 Walkie-Talkies.

4495 Kc.	5660 Kc.
4852.5 Kc.	5780 Kc.
5327 Kc.	5920 Kc.
5385 Kc.	6235 Kc.
5397 Kc.	6375 Kc.

SPECIAL PRICE TO CLEAR
7/6 each or 3 for £1
75c each or 3 for $2

CITIZENS BAND CRYSTALS

Miniature HC6/U ½" pin spacing
27.240 Megacycle 27/6 each.
26.785 Megacycle 27/6 each.
HC6/U Crystal Sockets 2/9
FT243 Crystal Sockets 2/9

CLIENTS NOTE, THE ABOVE FREQUENCIES ONLY AVAILABLE AT THE MOMENT.

ELECTROLYTIC CAPACITOR

Brand new Sub-miniature & Pigtail, PVC sleev

Mfd.	Volts	Price	Mfd.	Volts	Pric
2	12	30c (3/)	30	12	32c (3
4	3	30c (3/)	30	6	30c (3
5	6	30c (3/)	32	350	50c (5
5	12	30c (3/)	50	6	30c (3
5	18	35c (3/6)	50	12	35c (3
8	10	30c (3/)	50	25	45c (4
8	15	30c (3/)	64	6	32v (3
8	300	48c (4/9)	64	18	32c (3
8	600p	58c (5/9)	100	6	32c (3
10	3	30c (3/)	100	12	37c (3/
10	6	30c (3/)	100	25	50c (5/
10	12	30c (3/)	100	350	$1.50 (15
10	25	32c (3/3)	250	3	50c (5
16	10	32c (3/3)	250	16	50c (5
16	300	52c (5/3)	250	50	90c (9
15	600p	70c (7/)	500	12	50c (5
24	350	70c (7/)	500	50	$1.30 (13
24	500	75c (7/6)	1000	6	82c (8
25	3	30c (3/)	1000	12	98c (9
25	6	32c (3/3)	1000	18	$1.15 (11
25	12	30c (3/)	1000	25	$1.32 (13
25	25	35c (3/6)	50plus50	350	$1.60(1
25	50	42c (4/3)	(can type)		

VERNIER DIALS

Ratio 8 to 1, reduction, scaled 0-10.
Type T501, 1½in diam. $1.75 (17
Type T502, 2in diam. $2.20 (2
Type T503, 3in diam. $2.80 (2

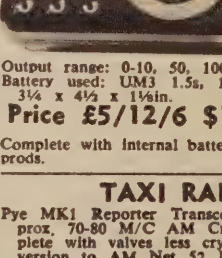
TRANSISTOR INTERCOM UNITS

4 Station; 1 master 3 sub-stations 3 Transist 250mW, Amplifier, Battery operated (Ev ready 216), complete with Battery, W Staples and fitting instructions $20.50 (£10/
Also 2 Station Model $13 (£6/1

THREE-STATION INTERCOMS as per abo photo—one master station and two sub-statio
£8/7/6 ($16.75)

MULTIMETER Model 200H

20,000 ohms per v. d.c. 10,000 ohms per v.



Specifications
DC volts: 0 25, 50, 2 500, 2,500.
AC volts: 0- 50, 100, 5 1,000.
DC curre 0-50 uA.; 250 mA.
Resistance: 0 K ohms; meg.
Capacity: 0. 0.3 uF; AC 0.0001 - 0 uF. (at 250v).
Decibel: Mi 20 db p 22 db.
Output range: 0-10, 50, 100, 500, 1,000.
Battery used: UM3 1.5s, 1-piece. Dimensio 3¼ x 4½ x 1⅛in.

Price £5/12/6 $11.25 inc. ta

Complete with internal battery, testing-leads prods.

TAXI RADIOS

Pye MK1 Reporter Transceivers Ex-Taxi. prox, 70-80 M/C AM Crystal Locked, co plete with valves less crystal, ideal for c version to AM Net 52 M/C. GOOD CO DITION .. .. $30 (£

ALIGNMENT TOOLS

Jabel No. 4 Alignment Tool Kits. All popu sizes, 4 Tools in Plastic Pouch .. $1.20 (1

GRID DIP OSCILLATORS

Lafayette TE-18 G.D.O. 8 Bands, Plug Coils, 360 Kc-220 M/C, 240 volt £19/1
Leader LDM-810 G.D.O. 2-250 M/C 6 Ba Plug-in Coils, 230 Volt £22/

IRUT's program in the Home Service of the Lebanon Broadcasting System is on 5980KC from 0430-0900, 1430-1830. On 9545KC the period of transmission is 0930-1400. All transmissions are in Arabic, according to the Swiss DX Session.

GERIA's latest schedule for transmission from Lagos is now on the air, 1300-2205 on 7275, 9690; 1300-1900 on 11915; 1500-1900 on 15255KC. The program in French is 1130-1400, 1900-2100, with news at 1900; English 1500-1600, 1700-1900, 2100-2200 with news 1500, 1700 and 2100. Hausa 1400-1500. and Arabic 1500-1700. The address is External Propagation Division. Nigerian Broadcasting Corporation, Broadcasting House, Lagos, Nigeria.

ANISH commercial station in Cordoba, "Radio Ana Lucia" has been heard in Europe on 6280KC. The transmission is 0600-0900 and for the period 0700-0800, the station has programs in Spanish, French and English. Madrid has been heard in the Radio Nacional de Espania transmissions on 9570KC from 1800GMT with 6140KC in relay and 7105KC.

RAWAK station of Radio Malaysia at Kuching is now on the following schedule; 2300-2400 English, 2400-0100 Chinese on 730, 3259, 4950, 7160KC: 2300-2330 Iban, 2330-2400 Bidayuh, 2400-0400 Malay on 850, 7270, 4835; 0400-5000 Chinese on 7160 and 4950, 0500-0530 English on 730, 7160, 4950; 0800-1030 in Malay, 1230-1400, 1500-1600 on 850, 4835; in Iban 1030-1230 1400-1500 on 850, 4835; English 1130-1230, 1400-1600 all on 730, 4950KC. English and Chinese programs also heard at 0900-1400 on 3385 and 1430-1600 on 3259 both 5KW. All other short wave frequencies are 10KW.

KAR over Radio Senegal now has daily programs in French to Western Europe, on 9675, with a native drum interval signal. Programs are 1730-1755, according to World Publications bulletin.

OZAMBIQUE station of the Radio Club of Mozambique at Lourenco Marques has made some frequency and program changes. The station is now in operation 0430-1630 on 737, 4925, 6112, 11820KC; 1630-1700 on 737, 4925; 1700-2100 on 737, 3260, 4925, for the "C" program. The Lourenco Marques "B" program is 0400-0430 4835, 11780; 0430-1630 4835, 5050, 11780; 1630-1700, 4835, 11780; 1700- 2200 on 3215, 4835; 2200-0400 on 3215, and on BC they operate 1500-0500 on 1358KC.

UTSCHE WELLE in Cologne has made an additional service to Africa, which is now Amharic 2110-2120, Swahili 2120-2140, English 2140-2200, French 2200 2220 on 9655 and 11785KC. This took effect on January 1, 1966.

TELEVISION DX

NEW ZEALAND.—Reception of some BC television programs is reported by J. Baptist, of Devonport, Tasmania, who, ing the summer period when TV DX is its best, reported good reception from eral New Zealand stations. He found the er-powered Invercargill translator, on Channel 1, blocked ATV 0 on Aust- an Channel 0, and also saw program terial which we were able to verify from TV 2 Dunedin and CHTV 3 Christ- rch, seen on one channel lower on stralian receivers. The Invercargill al blocked ATV 0 which is 250 miles n Devonport and generally gives good eption at Mr Baptist's location. He used crossfire and all-band antenna for such eption. He also saw an unidentified signal ch used stars in its test card on Aust. annel 2 at 0745GMT when the station viewed, but we presume this to be N 2 Wagga.

BROADCAST BAND NEWS

Increased power from several broadcast band stations is reported by European listeners, This could lead to even a better reception from some of these stations. Radio Tunis on 629KC, which should be heard this month at dawn, has made a power increase to 600KW. Radio Nigeria, at Kaduna, is operating on 940KC, with 250KW 0500-2200, and on SW they use 6090KC 0500-1535GMT. The 250KW transmitter has been used as from last month and replaces the old 10KW transmitter. Luxemburg is now 600KW on 1429KC and the program in English is 1800-0200. Radio Antilles on 926KC, 250KW is expected on the air this month.

NOTES from readers should be sent to ARTHUR CUSHEN, 212 Earn Street, Invercargill, N.Z. All times are Greenwich Mean Time, add 8 hours for Perth, 10 hours for Sydney, 12 hours for Wellington time. All frequencies are in kilocycles.

LONDON. The British Government has announced it intends to drive the off-shore stations off the air. The first pirate stations to close will be those on wartime forts, such as Radio City, Radio Essex and Radio 390 a new powerful station with a good music type of program. Legislation will be necessary to deal with ship stations, like Radio Caroline and Radio London, which are outside territorial waters, but the other stations on wartime gun sites in parts of the English Coast are inside the territorial limits and closure of the stations seems imminent, according to a report from English listener Roy Patrick of Derby, England.

AUSTRALIA — The latest Australian Broadcasting Commission station to come into service is 4QO, Eidsvold, which operates on 910KC with 5KW. This ABC station in Queensland also shares the same frequency as that of 4QB Maryborough, so that it will be difficult to verify reception of the new Eidsvold station unless it can be heard with a local newscast, as the program carried is the ABC Second and Third Network, also carried by 4QB. The station sign off, as is common with this ABC network, is 1405GMT.

U.S.S.R. — A new frequency has been put into operation by Radio Moscow's Far East relay station in Siberia. This is 710KC, which carries the English transmission to Australia 1330-1400. The program is also on 620KC. These frequencies, which replace the former 1250 and 1150KC channels, suffer from the Australian interference, as one can expect with ABC transmitters using the two channels to 1405GMT. ■

Be Paid What You are REALLY WORTH! $

Develop your aptitudes at your own pace, for recognition that brings HIGHER PAY. Begin YOUR Progress Today! Select the course you want and which will benefit you most. ICS will send YOU promptly — a FREE illustrated BOOK, giving FULL DETAILS.

GENERAL
Journalism — Short Stories
Writing for Radio & TV
Interior Decorating
Etiquette & Entertaining
Textiles
Photography
Mathematics
General Education
Dressmaking

DRAUGHTSMANSHIP
Architectural
Builders' Plan Drawing
Mechanical Structural
Surveying & Mapping

ILLUSTRATING
Still Life—Landscape
Caricature & Cartoons
Oil & Water Colour.
Fashion Drawing
Showcards & Tickets
Signwriting

COMMERCIAL
Accountancy
Cost Accountancy
General Bookkeeping
Salesmanship
Shorthand Typing
Retail Management
Commercial Managem't
Small Business Owners
Hotel-Motel Management
Club Administration
Window Dressing
Business Letters

BUILDING
Architecture
Building Contracting
Carpentry, Joinery
Structural Engineering
Concrete Engineering
Estimate & Quantities
Roofing, Steel Square
Timber Home Building

INDUSTRIAL
All Mechanical Eng.
Fitting & Turning
Soft Drink Manufacture
Air Conditioning
Gas or Elect. Welding
Chemistry, Plastics
Electronics
Electrical Mechanics
Radio Eng. or Service
Television
Refrigeration
Diesel Engines

Auto Mechanics
Civil Engineer
Production Managem't
Industrial Management
Executive Training
Modern Supervision

SPECIAL EXAMINATION COACHING COURSES
Account'cy: All Exams
Institute of Secretaries
Inst. Cost Accountants
Inst. Sales & Marketing.
Matric. or Leav. Cert.
Intermediate Certificate
Senior or Junior Public
C'wealth Clerical Exams
Police Entrance Exam
Nurses' Entrance Exam
Steam Certificate
Refrigeration Certificate
Radio Examinations
Inst. Auto. Mech. Engrs.
Inst. Diesel Engineers
Shire Overseers' Exam
Engineers' Institutions

ADVERTISING
Copywriting
Commercial Art
Advert'g Inst. Aust.

TO **INTERNATIONAL CORRESPONDENCE SCHOOLS,**
Dept. 526

SYDNEY: 400 Pacific H'way, Crow's Nest. Tele.: 43-2121.
MELBOURNE: 234 Collins Street. Tele.: 63-7327.
BRISBANE: Heindorff House, 171 Queen St., Brisbane. Tele.: 2-6125.
ADELAIDE: T. & G. Building, King William St. Tele.: W-4148.
PERTH: C'wealth Bank Building, 55 William St. Tele.:21-7268.
NEW ZEALAND: Wellington, 182 Wakefield St. Tele.: 53-109.

Please send Free Book on ....
NAME (Mr, Mrs, Miss) .... AGE ....
ADDRESS ....
.... STATE .... Dept. 526
OCCUPATION .... PHONE ....

EA-3-66

A.C.E.
AMPLIFICATION
COMMUNICATION
ELECTRONICS

★★★★★★★★★★★★★★★★★★★★★PHONE 51-38

RADIO

136 VICTORIA ROAD, MARRICKVILLE, SYDNEY,
AND 636 KING STREET, NEWTOWN—51-7008

EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW595
DULWICH HILL, EARLWOOD, BUS STOPS AT DOOR, STOP No. 42

NEW
HOME LIGHT BATTERY

CLYDE OR DUNLOP
19 Plate. 150 Amp.
Dry Charged. Cells.

£1/12/6 ea

A.C. D.C. MOTORS

32V and 110V
High Speed, Series Wound.
1/8 h.p. motors.

£1/17/6

Post. N.S.W. 7/6. Interstate 12/6.

NEW VALVES

1A3		7	6
1A5		7	6
1C5		7	6
1C6		12	6
1C7		5	0
1D5		5	7
1F5		10	0
1G4		7	6
1H5		7	6
1H4		7	6
1J6		12	6
1K7		5	0
1L4		5	0
1M5		5	0
1N5		7	6
1Q5		5	0
1T4		10	0
2A3	1	0	0
2C26		7	6
2X2-879		5	0
3A4		12	6
3B7		10	0
3D6		10	0
5U4		10	0
5X4		10	0
5Y4		10	0
5Z4		10	0
6AC7		7	6
6AG5		9	6
6AG7		10	0
6AJ5		5	0
6AK5		10	0
6AL5		7	6
6AM5		7	6
6AM6		7	6
6AN5		12	6
6AR6		12	6
6AN7	1	0	0
6AS7	1	0	0
6B6		7	6
6B8		7	6
6BF6		10	0
6BL8		7	6
6BM8		7	6
6BY7		7	6
6C8		7	6
6F6		10	0
6G6		7	6
6J5		9	6
6J6		7	6
6J6		10	0
6J7G		7	6
6K6		7	6
6K7		5	0
6N7		7	6
6SA7 Metal		7	6
6SC7		10	0
6SF7		10	0
6SG7		10	0
6SH7		4	0
6SJ7		9	6
6SK7		12	6
6SN7		7	6
6SS7		12	6
6X5		7	6
7C5		5	0
7N7		7	6
7W7		5	0
12A6		5	0
12AT7		10	0
12BE6		10	0
12BH7		7	6
12C8		12	6
12SJ7		12	6
12SK7		5	0
12SL7		12	6
47		12	6
76		7	6
84/624		12	6
304TH	1	10	0
723A	3	0	0
803	3	0	0
807	1	0	0
809		17	6
813	3	10	0
829B and Socket	2	17	6
843	1	10	0
866A		15	0
954		5	0
1603		5	0
1616		7	6
1619	1	0	0
1629		5	0
1050	1	0	0
9006		5	0
AV11		2	6
CA19	5	5	0
CK1013		15	0
CV63		7	6
CV66		7	6
CV1102		7	6
CV1133		7	6
CV1136		7	6
EBC33		7	6
EC70		4	0
ECH33		15	0
EF36		7	6
EF37		7	6
EF39		7	6
EF72		4	0
EF73		4	0
EK32		15	0
EL91		10	0
KTW62/6C7		7	6
RL27		15	0
RK34		7	6
RK75		10	0
RK84A	3	0	0
VR65		5	0
VR75 30		15	0
VR105/30		15	0
VR150/30		15	0
VT502		12	6
32		10	0
42		10	0
45		10	0
37		10	0
49		10	0
53		10	0
59		12	6
63		10	0
89		10	0
77		10	0
2V3		7	6
OZ4		7	6
CL4		12	6
EM1		12	6
EL32		12	6
TZ40		10	0
6AB7		7	6
6A3		12	6
6C6		12	6
6F7		12	6
6SC7		7	6
7A6		7	6
9006		5	0

GENEMOTORS

Input	Output					
12v	600v 300mA	New	£5	10	0
12v	500v 350mA		£8	10	0
12v	1200v 200mA		£6	10	0
24v	250v 100mA	New	£2	0	0
24v	540v 200mA	New	£3	0	0
24v	300v 250mA	New	£2	15	0
12v	275v 110mA		£3	10	0

CHASSIS PUNCHES

SIZES ⅝", ¾", ⅞", 1".
1⅛" with tapered
Reamer and Carry Box.

£2/17/6

Post 5/. Interstate 10/.

NEW POWER TRANSFORMERS

1960 5in CRO	5	17	6
325 x 325 150MA	4	15	0
285 x 285 300 MA	7	7	0
800V and 270V 300MA	7	10	0
240V-110V 1.3KVA Auto	10	10	0
150 x 150V 30 MA	1	7	6
225 x 225V 40 MA	1	10	0
124V Doubler 300MA	3	7	6
130V Doubler 400 MA	3	17	6
145V Doubler 450 MA	4	17	6
150V Doubler 500 MA	5	7	6
220V Doubler 600 MA	7	7	0
310 x 310 170 MA	2	9	6

3" SELSYN MOTORS—TRANSMITTERS

50 V AC — 50 cps.

£2/17/6 each

Post 7/6: Interstate 10/.

RELAYS

6V, 3-pole Miniature		15	0
12 volts. DPDT, 5 amp	£1	0	0
12 volts DPDT		13	6
100pf TX var. condensers		10	0
Hi-speed Polarised relay	£2	10	0

PMG TYPE 3000

2000 ohms 12/6.
1000 ohms 12/6.

Lapel Crystal Mikes		12	6
Crystal Mikes with switch		15	0
Telephone Pick-up Units		12	6
Contact Pick-up Units		15	0
100UA Stereo Bal Meters	£1	15	0

OIL FILLED CONDENSERS

.5mfd 600V		3	6
2mfd 600V		6	6
1mfd 600V		6	6
4mfd 600V		6	6
4mfd 2.5K	£1	10	0
1mfd 3000V		17	6
.5mfd 5K, .1 5K, .1 3K AC .25 4K, .5 2½K ea.		15	0
4 mfd 3000	1	15	0
2 mfd 3000	1	5	0
1 mfd 3000	1	0	0
1.25 mfd. 6000v.	3	5	0
mfd 4000v.	1	10	0
2 mfd. 2000v.		15	0
4 mfd. 1500v.		15	0
1 mfd. 1500v.		10	0
8 mfd. 600v.		10	0
1 mfd. 1000v.		10	0

PYE REPORTER

2-way Vehicle Band Transceivers.
Ex Taxi Cabs.
12 volt, 70 meg. Complete with valves and speaker.

£16/17/6

NEW C.R.O. TUBES

3API-906 3in	£1	7	6
CV112 5in	£1	0	0
VCR97 6in	£1	17	6
ACR10/VCR139A 3in	£1	10	0
CV1522 1¾in	£1	2	6

6" INDICATOR UNITS

TYPE 1A
Suitable for C.R.O. conversion.
Circuit supplied.

Price £10/7/6

NEW 3-GANG CONDENSERS

300 PF + 200 PF + 60 PF

7/6

NEW HEADPHONES

5 Ohm	£1	2	6
2000 Ohm	1	2	6
4000 Ohm	1	5	0
American Lightweight		12	6
Australian DLR		12	6
Dynamic Earpieces, pr.		4	6

Post., 2/6 pr.

100 NEW ASSORTED RESISTORS

Mainly I.R.C., ½, 1.2 Watt.
04 Values. ½ ohm. to 10 megs.

15/-, Post 2/6

100 new assorted Condensers.
Paper, Mica, Ceramic Metalcap.
25 Values.

£1/-/- Post., 2/6.

WANTED

Communications Receivers. Test equipment. P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone, any time.

TRANSISTORS

American Units.

MT-71-OC71		7	6
2N 174	2	10	0
2N 442	2	5	0
2N 441	2	0	0

High-powered units for 75-watt audio, 200-watt power units or transistor ignition.

T.B.Y. TRANSCEIVERS

20 to 80 Megs. Battery Operated. 4 Band units. Variable tuning.

£14/17/6

Complete with aerial. Headphones, microphone, junction box, plugs and cables.

£19/17/6

NEW G.M.F.

1/8 H.P. 240V-A.C. Motors
2 speed. Reversible.
Capacitor Start.
Double ended drive.
Ball bearings.

£2/15/-

NEW METERS

Square. Clear Plastic.

2¼in 50 UA	£2	7	6
3½in 50 UA	£2	17	6
2¼in V.U. Meters	£2	7	6
3½in I.M.A.	£2	7	6
2¼in 500V. A.C.	£2	2	6
2¼in 500V. D.C.	£1	15	0
3½in 500V. A.C.	£2	17	6
3½in 500V. D.C.	£2	10	0

Post. N.S.W., 2/6. Interstate, 4/.

INTER COM TELEPHONES

15 Line Connections.

£3/10/0 each

PILLOW PHONES

Low Imp. VC Matchings.
Ideal Hospitals, etc.

17/6 each

COMMUNICATION RECEIVERS

B.28—CR100

Current Navy Receiver
6 Band .40 K.C. to 32 M
Variable Selectivity. 2 R.F.
2 I.F. Stages. Crystal Gate B
Spread. New condition. Air-tes
Realigned 240V A.C. operati

£65/-/-

AR7 RECEIVERS

Air-tested, realigned. Perfect o

£57/10/-

MECHANICAL FILTE

For SSB Receivers.
455 KC. Balanced or unbala
as required.

£16/17/6 Post

3BZ RECEIVERS

AIR TESTED. PERFECT ORD
6v. Operation. 6 Ban
200 K.C. to 30 Megs.
Ideal communications Receiver
mobile and small ships' use.

£27/10/-

3 BZ TRANSMITTE

12V. Operation. 15 Watt O
2 to 9 Megs.
Air tested. Perfect order.
Suit small ships, Bush Fire Briga
Island Services.

£27/10/0

522 TRANSCEIVERS

Complete With Valves.
100 to 156 Megs.

£12/17/6

522 TRANSMITTER

Complete With Valves.

£6/15/0

522 RECEIVERS

Complete With Valves.

£5/15/0

NEW ROTARY CONVERTERS

160 watt. 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, Tape Recorders, Fluorescent Lights,

£19/17/6

450 Watt. as above.

£36/17/6

PHILLIPS No.4

COMMUNICATION RECEIVE
6V Operation. 500 KC to 18 m

£22/17/6

TECHNICAL BOOKS AND PUBLICATIONS

IALOGUE COMPUTING FOR BEGINNERS by K. A. Key, B.Sc. (Eng.). Crown 8vo., 176 pp., many circuits and diagrams. Published by Chapman and Hall Ltd., London, 1965. Price in Australia $4.25 (42/6) plus 12c (1/3) postage, where applicable.

A well-written introduction to the ana- ue computer and its operation. Although title reads "for beginners" this is in- ded to mean those lacking specific know- ge of the analogue computer rather than se lacking any mathematical or engineer- knowledge; in fact a fair level of training both the latter disciplines is neces- y for the book to be of much value.

The first five chapters cover introductory terial. What an analogue computer is, at it does, and how it does it; the use of entiometers, their functions and setting; operational amplifier and its use in nmation, integration, differentiation and ulation of complex transfer functions; nputer control and general operation; and rmionic and semiconductor diodes and ir applications.

The sixth chapter works through a simple mple—the classic "bouncing ball" prob- , used to illustrate how the various sical quantities are simulated. The enth chapter deals with basic diode cuits, including backlash simulation, uration simulation, comparators, and ited integrators.

Chapter eight discusses automatic con- ls, while chapter nine deals with vomultipliers and their uses in multiplica- , exponentials, division and switching. tenth and eleventh chapters deal with ped potentiometer and diode function erators. Chapters twelve to fourteen dis- s non-linear resistors, servo resolvers, and eration of time functions.

Plant control and data reduction are dealt h in chapter fifteen, while chapter six- n deals with vibration of coupled spring- ss systems. Chapter seventeen discusses important matter of stability. Chapter hteen describes the various output trans- cers—oscilloscopes, recorders and plotters, the final chapters deal with other types multiplier, function generators and trans- t delay.

The style throughout is concise and easily owed, and the book should be found st valuable by those needing a "short rse" in analogue computation—whether y be engineers, scientists, or students.

Our copy came from the Technical Book Magazine Co., Pty. Ltd., of 295-299 anston Street, Melbourne. (J. R.).

* * *

DAR—PRINCIPLES AND PRACTICE by Jonathan Mivec. Soft cover, 260 pages, size 9 x 6in, illustrated. Published by Tech-Press, Inc., Brownsburg, Indiana, U.S.A. Australian price $5.45 (54/6), plus postage 15c (1/6). Our copy from Technical Book and Magazine Co., 295 Swanston Street, Melbourne.

This book might have been subtitled "A dar Servicing Conversion Course," and m this the reader will gather that the k is intended to acquaint those involved h electronic servicing with the principles radar and to supply other data neces- for effective servicing of radar ipment.

Electronic servicemen unfamiliar with the ject have tended to regard radar as ething of a mystery and a branch of tronics reserved for the specialist, and must be admitted that opportunities for average serviceman to service radar in this country must be very limited, to say the least. However, the subject is sufficiently interesting to warrant inclusion in the general knowledge of the serviceman with an inquiring mind, as well as those who have intentions of becoming qualified to undertake radar servicing.

The theme of the book is set by the opening paragraphs which says: "Radar circuits are no more complicated than other electronic circuits. In fact, they are nothing more than combinations of circuits which have been used for many years in other equipment."

It is true to say that the serviceman familiar with and proficient in television techniques will find himself on quite familiar ground throughout most of the book, where frequent references occur to many circuit configurations used in television receivers, e.g., blocking oscillators, multivibrators, synchronising circuits, automatic frequency control and the like. He will find himself in unfamiliar territory in the chapters on waveguides and resonators, radar antennas and in parts of other chapters dealing with the circuitry peculiar to radar, but should have no difficulty following the clear explanations given.

Numerous diagrams are included to help the reader to follow the text, many of them showing the physical shape of radar hardware. (H.A.T.)

THE GREAT CIRCLE MAP OF
THE WORLD
WITH SYDNEY AS THE CENTRE
1966

MULLARD AUSTRALIA PTY. LTD. has prepared a great circle map of the world with Sydney as the centre, measuring 36 x 24in, and printed in four colours. The map is an azimuthal equidistant projection with which it is possible to determine the great circle bearing and distance in miles of any point on Earth from Sydney. An up-to-date tabulation of about 400 countries, with their prefixes, is also given. Price is $1.00 (10/), plus postage 20c (2/). The map is available from Mullard-Australia Pty. Ltd., 35-43 Clarence Street, Sydney.

NON LINEAR RESISTORS. Soft cover, size 8½ x 5¾in, 110 pages. Published by the Industrial Components Division of Philips Electrical Pty. Ltd., and available from Miniwatt Division, Box 34, P.O., Artarmon, N.S.W. Price 75c (7/6), post free.

This book is intended to be a complete survey of the Philips range of non-linear resistors available at the time of publication, comprising negative temperature co-efficient resistors, positive temperature co-efficient resistors, voltage dependent resistors and light dependent resistors. It includes details of manufacturing processes, electrical properties, measurements and other points of interest, but since it is not intended to be a text book, it does not contain any detailed information about the mechanisms which lead to the non-linear performance of the various devices listed.

It is rather intended to be a guide to the performance and physical characteristics, in the same way as a valve manual, for the guidance of intending users. Accordingly, it contains performance data, operating curves, and diagrams showing physical dimensions.

Separate sections are provided for NTCR's, PTCR's, VDR's and LDR's. Each section concludes with a survey of possible applications for each group of resistors, with circuit diagrams. (H.A.T.)

* * *

G-E SILICON CONTROLLED RECTIFIER MANUAL, third edition. Published by the Rectifier Components Department of the General Electric Company, Auburn, New York. Soft covers, durable spiral binding, 409 p.p., with many diagrams and circuits. Price in Australia $2.50 (25/-), post free.

Last December when I reviewed the latest edition of the G-E Transistor Manual I was able to say many nice things about it; at risk of being suspected a secret employee of G-E, I find I must repeat most of this praise in reviewing this latest edition of their SCR Manual. For it too is a most valuable and praiseworthy volume, albeit one with a more limited field of application.

Like the Transistor Manual it has undergone considerable growth: the first edition had 255 pages, this one has 409. And less than one quarter of these contain specification data; the rest contains theory, applications data and advice to designers. As with the Transistor Manual the book is not just a data handbook, but a carefully thought-out and well-executed textbook.

A list of the headings and the number of pages in each chapter is again most informative:

1. Construction and Basic Theory of Operation (12 pp.).
2. Symbols and Terminology (7 pp.).
3. Ratings and Characteristics of SCRs (19 pp.).
4. Gate Trigger Characteristics, Ratings and Methods (29 pp.).
5. Turn-Off Characteristics and Methods (29 pp.).
6. Series and Parallel Operation of SCRs (11 pp.).
7. Static Switching Circuits (21 pp.).
8. AC Phase Control (27 pp.).
9. Choppers, Inverters and Cycloinverters (41 pp.).
10. DC Regulated Power Supplies (9 pp.).
11. Light Sensitive Applications (13 pp.).
12. Gate Turn-Off Switch (15 pp.).
13. Protecting the SCR Against Overloads and Faults (13 pp.).
14. Voltage Transients in SCR Circuits (13 pp.).
15. Interaction and RF Interference in SCR Circuits (19 pp.).
16. Cooling the SCR (19 pp.).
17. SCR Reliability (21 pp.).
18. Test Circuits for SCRs (13 pp.).
19. Selecting the Proper SCR (3 pp.).
20. G-E Semi-conductor Specifications (68 pp.).
21. Application and Specification Literature (12 pp.).

It may be correctly inferred from this list that the book is most comprehensive in its coverage of the SCR and associated devices. Although written largely for the engineer and designer, its concise and lucid style would make it quite suitable as a reference or text for the technician, student or hobbyist.

As with the Transistor Manual the amazingly low price ($2.50 post free) makes it excellent value for money.

Our copy came direct from A.G.E. Pty. Ltd. at 103 York Street, Sydney, from whom copies may be purchased by mail. However the book may also be obtained at all leading booksellers. (J.R.)

* * *

RADIO AND TELEVISION SERVICING, ELECTRONICS SERVICING, Specimen Answers to Intermediate Papers 1961-64, City and Guilds of London Institute and The Radio Trades Examination Board, by F. O. M. Bennewitz. Soft cover, 8½ x 5½ inches, 94 pages, with illustrations and circuit diagrams. Published by Norman Price (Publishers) Ltd., London. Australian price $1.50 (15s).

Lack of examination technique, and failure to understand what was required of him in presenting his answers, has cost many a student a pass mark in examinations. Very few teachers and lecturers seem to realise that students need instruction in this aspect of preparation for examinations, and many students themselves seem not to appreciate the importance of knowing the right approach to answering questions.

This little book contains a number of past examination questions, followed by model answers. The author explains that the type of answer he has given is typical of what is expected in an examination, and is what the student should aim for. Because of the limited time available during examinations of this kind, no attempt has been made to cover every aspect of the questions.

Apart from its value in helping the student to gain examination technique, the book contains summaries of many technical points at an intermediate level which are useful for reference purposes. Our copy was supplied by Electronic Publications (Australia), 53 Stanley Street, Peakhurst, N.S.W. (H.A.T.)

* * *

AUSTRALIAN GENERAL ELECTRIC advise readers that the following G.E. manuals are available from their office at 103 York Street, Sydney. Prices are as marked.

Transistor Manual, 7th edition (650 pp.)	$3.00 (30/).
SRC Manual, 3rd edition (409 pp.)	$2.50 (25/).
Glow Tube Manual (105 pp.)	$1.25 (12/6).
Rectifier Guide 2nd edition (142 pp.)	$0.75 (7/6).
Tunnel Diode Manual (96 pp.)	$1.25 (12/6).
Essential Valve Characteristics (302 pp.)	$1.80 (18/).

* * *

MULLARD OUTLOOK issue of November-December, 1965 (Vol. 8, No. 6) contains the following major articles: The Picture is Bright on Tubes, a summary of improvements in TV picture tube design that have led to present compact high reliability types; Ferroxcube Selection Chart, giving brief details of the different grades of manganese-zinc and nickel-zinc ferrites and typical applications; Thermistor Thermometer, describing a battery-operated thermometer for measuring surface temperatures from 20 to 90 degrees C. Information is also given about the following new products: types C004EB/6E (6uF) and C004EB/12E (12uF) trimmer capacitors, which are high quality ceramic trimmers with locking facility; Norbit Timer YL6015, a new sub-assembly added to the Mullard Norbit range; Luxistor ORP39, an inexpensive variable resistor with noise-free control. (Mullard-Australia Pty. Ltd., 35-43 Clarence St., Sydney.)

* * *

HEWLETT PACKARD JOURNAL for December, 1965, (Vol. 17, No. 4) is devoted almost entirely to articles about the new "hot carrier" diodes, which are semi-conductor devices offering a number of advantages over p-n junctions and point contact diodes. In addition to a brief description of hot carrier diodes and some of their properties, there are articles on the use of these devices as detector and mixer, dealing particularly with advances in performance possible with these diodes. (Inquiries should be sent to the Australian agents, Sample Electronics (Vic.) Pty. Ltd., 9-11 Cremorne Street, Richmond, E1., Victoria).

* * *

PHILLIPS SCIENTIFIC AND INDUSTRIAL NEWS BULLETIN for December, 1965, has articles on optical emission spectrometer made by the Belgian company M.B.L.E.; Philips closed circuit TV equipment; The Philips EL 3400 video tape recorder for non-professional use; Of Coherence, a comparison of the principles of coherence in radio and light waves; A20 Cryogenerators, the second part of an article describing the Philips-Stirling system for generating low temperatures; Radio Carbon and Tritium, and equipment for their measurement in the gaseous phase; An Introduction to Ultrasonic Testing, part 2 of a series of articles on non-destructive testing; A Large Area Low-level Beta Detector, describing a gas flow anti-coincidence low-level detector of large sensitive area for measuring alpha and beta radiation; A Transistorised Radiation Monitor. (Inquiries to Philips Electrical Pty. Ltd., 69-79 Clarence Street, Sydney).

* * *

NEW DEVELOPMENTS, the new products bulletin of Jacoby Mitchell and Co. Pty. Ltd., has product information on the Weinschel Engineering microwave interferometer; Lionmount decade inductance box; Telequipment D53 CRO with double display mesh tube and inbuilt sweep and signal delay; Weston Electronics stabilised DC power supplies; Telequipment "Servicescope Minor" a low-cost CRO developed for school use; Tokyo Optical Co. Toko measuring projectors; International Electrc
double DC power units. (Jacoby Mit
and Co. Pty. Ltd., 469-475 Kent St
Sydney).

* * *

**HEWLETT PACKARD MEASU
MENT NEWS** contains information a
the following products: Model 70
low-cost solid-state X-Y recorder w
will draw a 70 x 10in graph of two rel
functions; Models 400E and 400EL
Voltmeter, latest additions to the M
400 range. They are solid state 10cps-10
instruments for voltages from 1mV
300V RMS; Model 1416A swept frequ
indicator designed as a complementary
to the Model 140A oscilloscope to a
swept frequency measurements of atte
tion and reflection; The MPB series of
regulation (0.01 per cent) medium p
bench power supply units, comprising
units in all with output ranges up
100V DC or 10A: Model 334A and 3
distortion analysers with automatic nul
Model 1403A guarded differential ampli
designed as a plug-in unit for the
140A CRO; Model 222A general pur
pulse generator; Model 3439A digital
meter with provision for plug-in acces
units.

(Inquiries to Sample Electronics (
Pty. Ltd., 9-11 Cremorne Street, Richm
E.1., Victoria).

* * *

**AMALGAMATED WIRELESS VA
CO. PTY. LTD.** has an interesting broc
dealing with the development by RCA
the "Overlay" transistor. It takes the f
of articles reprinted from the U.S.A. m
zine "Electronics" with numerous illu
tions in full colour and circuit
grams showing typical applications of
overlay transistors. The first article, "
Geometry Boosts Power," explains
the overlay types are able to handle l
current flow by multiple emitters conne
in parallel, and gives a detailed descrip
of the construction techniques invol
Then follows an article on applicat
entitled "Putting the Overlay to Work
High Frequencies." The final article
how companies other than RCA are
proaching the design problems of mul
emitter HF transistors.

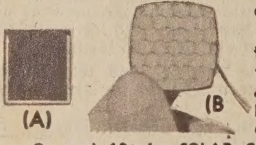
An application note entitled "Freque
Multiplication Using Overlay Transist
is also available on request from A
This tells how overlay transistors can
used in frequency-multiplier circuits to
erate watts of harmonic output p
at microwave frequencies. The text is
lustrated with circuit diagrams and perfo
ance curves.

Both these publications are available
from AWV, postal address Box 63, P
Rydalmere, N.S.W.

* * *

**NATIONAL BUREAU OF STA
ARDS TECHNICAL NEWS BULLE**
for November, 1965, (Vol 49, No.
contains the following articles: Guidel
devised for corrosion protection, descri
a method of protecting ferrous pipel
from corrosion by externally applied
rents: Improved OMNITAB Gains W
Acceptance, which contains informa
about an NBS-developed computer prog
that allows untrained personnel to c
municate with a 7094 computer using sin
written sentence commands; Alpha Part
Scattering describes a method of measu
energy and angular distribution of a
particles backscattered from metallic so
mounts; Transducer Allows Accurate M
surement of Corrosive Gas Pressures, re
to a new transducer developed at the
Institute for Basic Standards. Other t
are: Mechanism proposed for the Sol
Effect; New NBS Force-calibrated Fa
ties; Nitrogen Oxides Improve Asphalt;
operative Studies on the Problems of Ha
ling Space Fuels; Polarisation Meas
ment in the Vacuum Ultraviolet. (Inq
ies to Superintendent of Documents,
Government Printing Office, Washing
D.C., 20402.)

The Tools of Tomorrow . . . Today!



● SPECIAL Solar and Photocell kit, contains 7 cells and 24 page book.
Only $12.50 Pp.
Or send 10c for SOLAR CELL Details.

● MOIRE KITS Get the jump on competition. Here's a brand new technology.
Already used commercially in U.S.A. In many industries. Send 50c for booklet and details.

● DIFFRACTION GRATING Replica. Exciting new development . . . Transmission and Reflection Types now available. Send 10c for details.

● DIGI COMP Working Model DIGITAL COMPUTER. Teachers computer fundamentals, solves problems, adds, subtracts, multiplies, complements, shifts, carries, memorises, compares, sequences. Kit includes assembly diagrams and 28-page manual on operating, computer language (Binary system), programming, problems, experiments. ONLY $10.50 pp.

● An Introduction To Outer Space . . . STAR AND SPACE MAPS, ASTRO MURALS, etc. Send 10c for details.

● BOOKS GALORE on Ultra Violet, Telescopes, Science, Solar Energy, Infrared Light, Astronomy, Telephoto Lens, Photography, Maths., Optics. Send 10c for details.

DEPT. EL3, "NEW ERA"
Box 3702, G.P.O., SYDNEY, N.S.W.,
Australia.

CLASSIFIED ADVERTISING

Advertisements in these columns cost $0.50 (5/) per line. Each line contains the equivalent of five words each of nine letters. Minimum size of advertisements is two lines. PAYMENT MUST ACCOMPANY ALL ADVERTISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the April issue must reach our office before March 9th. Address your advertisement to the Advertising Manager, ELECTRONICS Australia, Box 2728, G.P.O., Sydney.

FOR SALE

PE RECORDER BARGAINS. New and used
chines. Buy from a technician, not a sales-
an. Free technical advice. All repairs and
cessories. Country inquiries welcomed. Tom-
's Radio, 528 Liverpool Rd, South Strathfield,
S.W. 642-4215, Sydney.

R AUTOMATIC TAPE RECORDERS. For those
o want the ultimate in perfection. Sound
erated relays, built-in 2-channel mixer, auto
de projection, 4 heads, 4 tracks, 4-speed
and B monitors, reverb., echo., stereo, mono
q. range to 20Kc, plus or minus 3db
namic range to 60db. Wow and flutter less
an 15 per cent, channel sep. 50db. V.U.
ters, auto. rewind, clutches for tape protec-
n, sound on sound, gold relay contacts, auto.
rque controls, remote control, rewind, play-
ck recording stop and start, disconnectable
to. recording level control, batt. and A.C.
eration, etc., etc. German made, light and
mpact. You will never see more features or
ality for your money. Push-button control. A
eam to operate and own. Prices from £145 to
50/10/. N.S.W. Distributors: Tomlin's Radio,
8 Liverpool Rd, South Strathfield, 642-4215.
untry and Trade inquiries welcome.

GAN COMPONENTS. Send for our illustrated
alogue listing parts, kitsets, circuit data and
ctronic organ keyboards, pedal boards, con-
t wires, wiper plates, contact blocks, stop
itches, stop tabs, piston switches, coupler
itches, multi-type relays, toe pistons, expres-
n controls, solenoids, etc. Also many sundry
rts such as felt strips, springs, felt washer,
readed rod and components for pneumatic
tion.
For the benefit of experimenters we list sets
data sheets available for several different
signs of organs.
Alan Douglas, a transistorised design and the
lyde organ construction kitset. "Harmonics"
e-assembled units and complete organs.
Please send 5/ cheque or postal note to cover
rt cost of printing and posting. Peska Pty.
d., P.O. Box 306, Frankston, Vic.

PICTURE TUBES:
1-year warranty, £7.
2-year warranty. £10.
Plus old tube. Special prices to the trade.
types except bonded and 27in. These tubes
ve an all new gun (cathode, heater, base.
c.). All duds must be under vacuum and
ratch free. When ordering by mail add freight.
stributors wanted. Sure Brite Picture Tubes.
a Victoria St, Lewisham, Sydney, N.S.W. Ph.:
-7743.

NUINE polished colourful North-West Gem-
one pendants, rolled gold or silver chains.
cellent Xmas gifts. Send Postal Note 17/6
ch, two for 30/. Trade enquiries welcome.
. A. Gemstone, Box 42(E), Applecross, W.A.

NERALS. 10 samples of W.A. minerals in
tractive plastic box, including hermatite, zir-
n, beryl, galena, ilmenite, etc., with literature.
eal for students, rockhunters. Send postal note
/. Box 42(E), Applecross, W.A.

RRARD Autoslim Stereo. 4-speed Record-
angers. These new, popular, latest model units
ailable now. £12. Post and packing: N.S.W.,
/; Qld., Vic., Tas., 22/6; W.A., S.A., 30/.
PROFESSIONAL TV SERVICE,
Box 36, Queen Vic. Building P.O., Sydney.

L "Tasma FM4000" VHF Base Station, QATB,
risbane. Phone 2-2121, Q'LD.

STOM-BUILT TRANSFORMERS—Power, Audio,
c. Single or quantity production. Battery
argers, rectifiers, electric motors, transistor
dios. General engineering, fitting and turn-
g sheet metal work, etc. PARKINSON
RANSFORMERS, P.O. Box 523, South Brisbane.
one Beenleigh 33, Qld.

E 62 TRANSCEIVER, 1.6—9MC, as new,
orking order. Offer. 5 White Ave, N. Kew,
c.

ANSISTOR MK4 RECEIVER KITSET. The 4
ansistors produce very high sensitivity because
an efficient reflexing circuit, coupled to a
n speaker via a high gain audio amplifier.
e set is housed in an attractive cabinet which
leather-covered. Size: 9in x 5in x 2in. Kit
complete to the last screw, including battery
d step by step instructions. Special price,
7/2/6 ($14.25). Postage 2/ (20c). HAL-
ARD ELECTRONICS, Box 58, P.O., Campsie,
.S.W.

AND K. Television Analyst, Model 1076,
uipped with Flying Spot Scanner. Save valu-
le time on all types of TV servicing. Also
.W.A. Model P75 VTVM. Both instruments
e as new and have been used for demon-
ration purposes only. For further information
ntact: J. BROOKS, Electronic Specialists, 377
d South Head Road, North Bondi, N.S.W.
hone 30-2823).

E Truvox Tapedeck MkIII. One associated
nplifier, 2 watt output. Cabinet mounted 12-
ch speaker. Best offer. 92-7511. Vic.

LA 12UX Speaker, £12. Garrard arm with
ereo cartridge, £4. Sydney, 53-7125, N.S.W.

ANSISTOR components sale. Ganged tuning
ndenser, 5/9 (58c), OC71 pair, 13/ ($1.30).
ALLARD ELECTRONICS, Box 58, P.O.,
ampsie, N.S.W.

FOR SALE

OUTSTANDING Hi-Fi Stereo System, brand new, fully import. Components: Fisher ampl. X-202-B (80W), Thorens record player TD-124, SME pick-up arm 3012, 3 Shure 15 degree diamond styli, Dual record changer 1009, 2 KEF Slimline K1 Loudsp. systems. Complete sale only for German retail price $1,360—total. Further 1 aut. slide projector Leitz Pradovit n-24, $130. A proj. screen, 5ft x 5ft, in port. case, $98. KLINKMANN, 5/64 Station Rd, Auburn, N.S.W.

SELL Recond. Mono MKII Armstrong amp. for $80. C. ROBERTSON, 55A Wharton St, Moorooka, Bris. 48-7598, Qld.

NEW OC44, 45, 71, 72, 73, 74, CFT122, 108, 152, 2N217, 2695, 7/ ea. OC84, OA210, 7/6 ea. OA211, 10/ ea. OC171, 2N370, 371, AF116N, 117N, BYZ13, OA31, 12/6 ea. 2N301, 257, 16/ ea. OC23, 28, 29, 35, SFT240, 21/ ea. OA5, 10, 81, 85, 91, 95, 3/ ea. New Recording Tape, 1800ft, 7in reel, 30/ ea. No S.A. Sales. Pack and post 1/6. CUSTOM ELECTRONICS, Box 1452, G.P.O., Adelaide, S.A.

SELL, all back issues "Electronics Aust." in stock at all times. 1939-55 copies 20c, 56-59 30c, 1960 to date 40c. Post incl. T. WEIR, 56 O'Connor St, Haberfield, Sydney, 71-2569. Wanted to buy copies.

AKAI M7 Tape Recorder, very good condition, £165. BAKER. 639-4849, N.S.W.

LOUDSPEAKER, Midax mid-range horn unit. Perfect cond. $35 plus freight. C. G. WEST, 15 Elizabeth St, Eastwood, S.A.

TAPE Recorder, latest Akai model 910, 2 only, £75 each. Write VK6ES, 842 Canning Hwy., Applecross, W.A.

QUANTITY aircraft radio components, spares and test gear. Contact Mr W. Reynolds, T.A.A. BULK STORE, Melbourne Airport, Essendon. Victoria phone 379-4044, ext. 269.

HALLICRAFTER SX101 Ham band RX. Switched SB. Xtal cal. N.L. T-notch Fil. £120 S.A.E. Info. 25 Millen St, Hughes, A.CT

TRANSISTORISED RF. amplifier kitset. Can be attached to any transistor or valve receiver without circuit alterations. Excellent for use in areas of low signal strength and car radios. Unit increases sig/noise ratio, sensitivity, and selectivity. Power Gain:—30dB. Small in size. Full price 35/. HALLARD ELECTRONICS, Box 58, P.O., Campsie, N.S.W.

HEATHKIT 5in CRO, TV alignment generator, VTVM, also Veriac, isolating trans signal generator and rack. All for $200. McSwain, 19 Tulip Street, Black Rock, Vic.

RECORDING Tapes, Mylar $3\frac{3}{4}$in x 350ft, 80c; 5in x 900ft, $2.20; 7in x 2,400ft, $4.50; PVC 5in x 900ft, $1.80; 7in x 2,000ft, $3. All sizes stocked. Fully guaranteed. Post free. AIMO, Box 15, Footscray, Vic.

PHILIPS GM5659 CRO, Philips GM2889 marker. All probes near new. $420. 50-6350, Sydney, N.S.W.

SPECIAL PURCHASE. English Battery Charger Kitsets. $2\frac{1}{2}$ amp 6 or 12 volts. Kit includes metal case (punched and drilled), T/F, F.W. rect, 6/12V panel and plug, fuseholder and fuse, grommets battery clips and circuit. Price only $7.75 (£3/17/6), including sales-tax and postage. Also makes a fine train or model transformer.

Can never be repeated at this price.

Peak Electrics, P.O. Box 123, Crow's Nest, N.S.W., 90-5156.

WHARFDALE RS12DD and cabinet, phone Sydney 95-4492.

MODEL Engineering Supplies, Blue Prints, Castings, Boiler Fittings. BOLTON, 70 King St, Sydney. Catalogue 75c. N.S.W.

No. 22 Transceiver, complete, excellent order. £25, freight paid. J. RUSSELL, 20 Station St, Whitebridge, N.S.W.

READER SERVICE

MICROGROOVE discs from your tapes. Also tape copying service. Highest quality discs at all speeds. Prompt service. Moderate charges. Country and interstate inquiries welcomed. Vitatone Recording Studios, Box 18, Post Office, Lane Cove. N.S.W. Phone (Sydney) 42-6154.

ELECTRONIC ORGANS. Do not build yourself an organ without first consulting us. Send for initial information on the superb Schober (U.S.A.) build-it-yourself kits. No stamps required. The Electronic Organ Co., 124 Livingstone Ave, Pymble, N.S.W. (Mail only).

REPAIRS TO RECEIVERS, transmitters, construction, testing, TV alignments, Xtal convs., any frequency. £20/10/ plus tax. Eccleston Electronics, 146a Cotham Rd., Kew, Vic. 80-3777.

TAPE RECORDER OWNERS! Join Australia's most progressive tape recording organisation offering a monthly magazine — "The Microphone," bi-monthly "Newstapes," and full discount service. Full details are available from the Secretary, A.T.R.S., Box 9, P.O., Crow's Nest, N.S.W.

POSITIONS VACANT

TELEVISION TECHNICIANS FOR NEW ZEALAND
TISCO (N.Z.) LTD., New Zealand's largest TV Service Company, require top grade TV Technicians for many of their 30 Branches throughout New Zealand.

Wages £A25 per week, plus fringe benefits. All overtime after 5 p.m., Monday to Friday, and all day Saturday paid at full penalty rates. No Sunday work.

Air fares for technicians and dependants paid in full.

For further details, write in confidence, enclosing copy of references, to:

The General Manager,
TELEVISION INSTALLATION AND SERVICE
CO. LTD.,
P.O. Box 9332,
Auckland.
NEW ZEALAND.

CAPABLE Instrument Fitter can earn good money in spare time on repair of el. meters. Apply P.O. Box 151, Double Bay, N.S.W.

COMPUTER CIRCUIT BOARDS

20c (2/-) per transistor, includes all condensers, resistors, diodes, etc. $2.00 (£1) minimum order. Limited stock.

Australian Electronics
76 View St., Hobart, Tas.

Stotts

TECHNICAL CORRESPONDENCE COLLEGE

Stott's renowned home-study courses can raise your pay. Each course has been prepared by highly-qualified professionals. Stott's step-by-step instruction plus the personal tuition of expert instructors will ensure fast and thorough progress.

( ) Radio for Amateurs
( ) Automobile Mechanics
( ) Diesel Engineering
( ) Machine Shop Practice
( ) Fitting; Lathe Work
( ) Milling, Grinding
( ) Shaping, Planing, Slotting
( ) Mechanical Draftsmanship
( ) Survey Plan Drawing
( ) Boiler Attendants' Exam
( ) Mechanical Engineering
( ) Structural Draftsmanship

Stott's curriculum contains over 100 courses.

POST THIS COUPON NOW

STOTT'S TECHNICAL CORRESPONDENCE COLLEGE

157 Flinders Lane, Melb. 383 George St., Sydney. 290 Adelaide St., Brisbane. 45 Gilles St., Adelaide. 1130 Hay St., Perth.

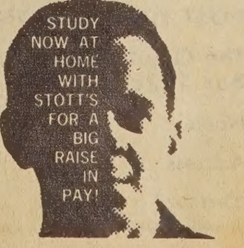
Please send me your prospectus on ....

....

MR.
MRS. ....
MISS
ADDRESS ....

.... AGE ....

I understand that no sales representative will call on me.
RH366.



CLASSIFIED ADVERTISERS

USE THIS FORM FOR YOUR NEXT ADVERTISEMENT TO APPEAR IN THE

ELECTRONICS Australia Classified Columns

To the Advertising Manager,
ELECTRONICS Australia,
Box 2728 G.P.O.
Sydney.

ENDORSEMENT ....

ADDRESS .... STATE ....

- *Please insert the following advertisement in the*

.................*issue*

- *I enclose P. Note/Cheque for $....*

£....s....d.... being full payment for .... lines at $0-50 (5/-) per line.

☐ FOR SALE ☐ WANTED ☐ READER SERVICE ☐ POSITION VACANT

Please write in block letters with ink or ball-point pen. Number of insertions ....

"ELECTRONICS Australia"

SPECIAL ORDER FORM

Guarantee yourself a complete set of issues for your library with no copies missing.

SUBSCRIPTION RATES

		PER YEAR
Commonwealth, Fiji, N. Guinea	$3-50	£1.15.0
United Kingdom & N. Zealand	$4-00	£A2. 0.0
British Dominions	$4-00	£A2. 0.0
Foreign	$5-00	£A2.10.0

POST THIS COUPON TO:—

The Circulation Manager, ELECTRONICS Australia,
Box 2728, G.P.O., Sydney. Australia.

Name ....

Address ....

Enclosed is $............ *for* ...... *years. Start with* ....

ADVERTISING INDEX

A.C.E. Radio 116, 130, 131, 13
Adcola Products Pty. Ltd. ....
AKAI Electric Co. Ltd. ....
Amalgamated Wireless (A'sia) Ltd. Inside Front Cover, 8, 44, 9
Amateur Astronomer ....
Amolion (A'sia) Pty. Ltd. ....
Anodeon Sales Division ....
Arrow Electronics Pty. Ltd. ....
Australian Radio and TV College Back
Asdic Stereo Specialists and Brisbane Agencies .... Inside Back
Audio Eng. Pty. Ltd. ....
Australian Electronics ....
Australian Sound and TV Pty. Ltd. ....
Austral Radio Parts Service ....

Bright Star Radio ....
Broadway Electronics Pty. Ltd. 2,
Broughton, Peter ....

Classic Radio ....
Classified ....
Convoy International ....
Cunningham R. H., Pty. Ltd. 4

Decca ....
Deitch Bros. ....
Deitron Electronics ....

Electronics Developments Pty. Ltd. 10
Encel Electronics ....
Ericsson L. M., Pty. Ltd. ....

Fairchild (Aust.) Pty. Ltd. 4
Ferguson (Adelaide) Pty. Ltd. 5

General Accessories Pty. Ltd. ....
General Electric Pty. Ltd. ....
Goldring Eng Pty. Ltd. 53, 100
Goodmans ....
G.R.D. Instruments Pty. Ltd. ....

Ham Radio Suppliers ....
Hare and Forbes Pty. Ltd. ....
H.B. Radio Products 105
Homecrafts Pty. Ltd. ....

International Correspondence School ....

Jacoby Mitchell and Co. Pty. Ltd. ....
JH Reproducers Pty. Ltd ....
Johnston D. R. & Co. Pty. Ltd. ....

Kodak (Australasia) Pty. Ltd. ....
Kuenzli, Ernest Pty. Ltd. ....

Lafayette Electronics ....

McLellan W. J. Pty. Ltd. ....
Man's World ....
Manufacturers Special Products 37,76,
Marconi School ....
Master Electrics Pty. Ltd. ....
Mastersound Sales Pty. Ltd. ....
Maurice Chapman Pty. Ltd. ....
Minithern Products ....
Mullard-Aust. Pty.Ltd. ....

National Radio Supplies 8
New Era Products ....

Paton Electrical Pty. Ltd. ....
Precision Windings ....
Pye Pty. Ltd. ....

Radio Despatch Service ....
Radio House Pty. Ltd. ....
Ralmar Agencies ....
R.C.A., of Aust. Pty. Ltd. ....
R.C.S. Radio Pty. Ltd. ....
Recorded Music Salon 92
Rola Special Products Pty. Ltd. 6
Rowe H. and Co. Pty. Ltd. 3

Selectronics Pty. Ltd. ....
Simon Gray Pty. Ltd. 24, 8
Stotts Correspondence School ....
Sure Brite Picture Tubes ....

Tecnico-Electronics Pty. Ltd. ....
Tekni-Cals ....
Thorn Special Products ....
Top Management Services ....
T.O.S.C.A. Pty. Ltd. ....
Trio Corporation ....
The Reader's Digest ....
Transistor Kits ....
Tudor Radio ....

United Radio Distributors Pty. Ltd.
University Graham Instruments Pty. Ltd.

Veroboard (E.M.I.) Pty. Ltd. ....

Warburton Franki Ltd. 3
Watkin Wynne Pty. Ltd. 47
Watson Victor Pty. Ltd. ....
Willis, S. E. Trading Co. ....
Wonder Wool ....

Zephyr Products Pty. Ltd. .... 46.